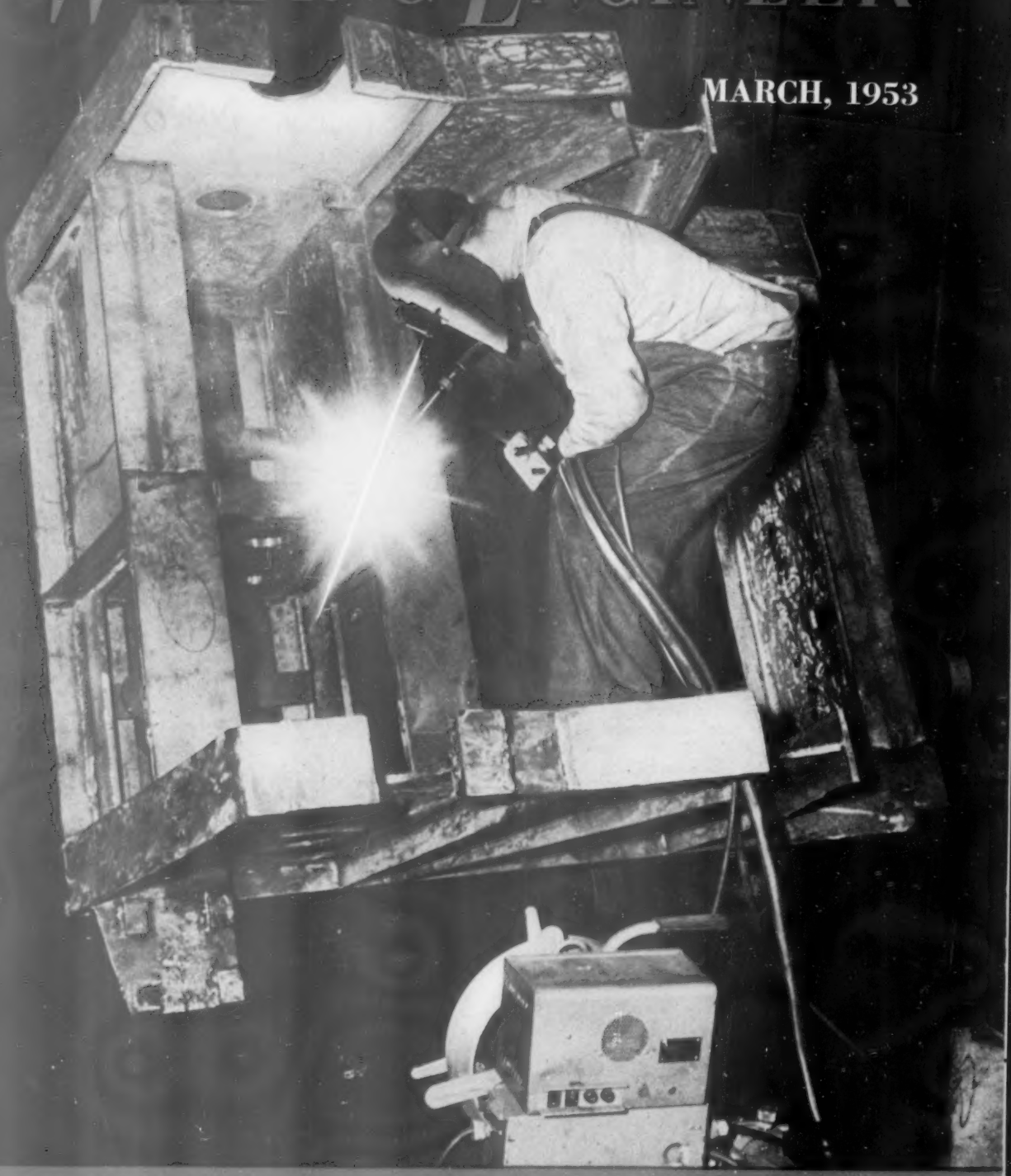
35¢

THE WELDING ENGINEER

MARCH, 1953

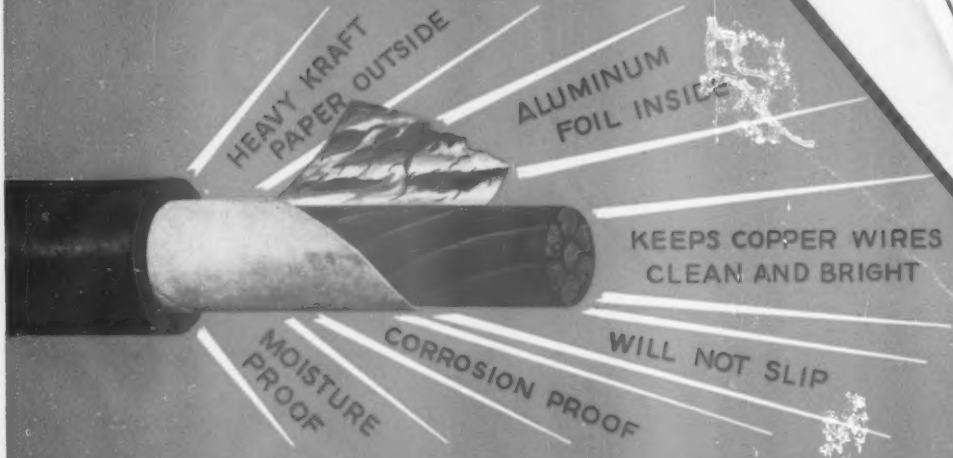


Brazing as a Production Medium . . . page 52

A McGRAW-HILL PUBLICATION

TOUGH
EXTRA FLEXIBLE
EASY to USE

FOR 50 YEARS *Wiremaker for Industry*



To You, Belden's Golden Anniversary Means

—product performance that can come only from a "know-how" that has grown through actual service since the early days of the construction industry.

—an ability to cooperate in pioneering new wires to meet or anticipate industry's growing needs.

In the years that follow This Belden Program Is—

TO BE CONTINUED

Belden Welding Cable FEATURES

THE CONDUCTOR

The conductor is composed of many electrically pure copper strands. Each strand is accurately drawn and annealed. Annealing makes the wire soft and flexible.

Thousands of copper strands are grouped into seven divisions, six of which are positioned concentrically around the center group. The strain of flexing is distributed equally throughout all the strands.

Conductor flexibility is the first important step in building desirable welding cable.

THE SEPARATOR

The separator on Belden cable consists of tough kraft paper armorized with aluminum foil. This is an exclusive development.

The aluminum foil faces against the conductor and prevents moisture and chemicals (such as sulphur) from reaching the copper conductor. This means the copper conductor will remain clean and bright.

The aluminum foil also hugs the copper conductor tightly and prevents the jacket from slipping on the conductor.

THE JACKET

The Belden jacket compound has been scientifically formulated with the latest in protective ingredients to insure maximum resistance to the destructive effects of heat and time. This rubber jacket is tested for aging in an oxygen bomb under heat for 14 days, approximately equivalent to 10½ years' service. It still remains lively and flexible after such exposure.

Adequate electrical insulating properties have been developed for the jacket compound.

Specify Belden Belden Manufacturing Co., 4677-A W. Van Buren St., Chicago 44, Illinois

Belden
Welding CABLE

electrodes

HOBART

- Give you easy arc control and metal transfer. Give you top performance under all conditions. Give you excellent physical properties. Give you high deposit efficiency with thorough penetration.

dependable uniformity in all types and sizes

No matter what your problems, there is a type and size Hobart Electrode to do your welding job better, at lowest cost.

HOBART "12" AWS ASTM E6012. A mild steel DC or AC for all position welding—straight polarity.

HOBART "10" AWS ASTM E6010. A mild steel rod for direct current welding in flat, vertical, and overhead positions.

HOBART "13" AWS ASTM E6013. A mild steel rod for all position welding with both alternating and direct current.

HOBART "111" AWS ASTM E6020. A mild steel rod for horizontal fillet and downhand welding, AC or DC.

HOBART "TUFANHARD." A rod recommended for hard surfacing, DC or AC.

Mail the coupon for complete details on welders and electrodes.

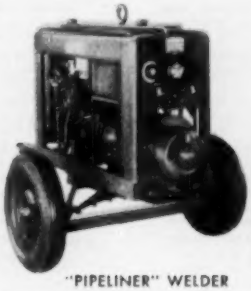
HOBART

arc welders

If you want lower costs and constant performance so essential to profitable production welding, we ask you to check a HOBART point for point against any other welder. Hobart advanced design, heavy duty construction, and features such as remote control on standard models have earned it top position in the welder field. Why not mail the coupon for complete details and convince yourself.

Hobart Brothers Co., Box U-33, Troy, Ohio
"One of the World's Largest Builders of Arc Welders"

GAS DRIVE WELDER



"PIPELINER" WELDER

"BANTAM CHAMP" WELDER

☐ FREE

"How to get better welds." Valuable new vest pocket booklet.

● HOBART BROTHERS COMPANY, BOX U-33, TROY, OHIO

Without obligation, send information on items checked below:
☐ Electric Drive Welder ☐ Gas Drive Welder ☐ Pipeliner Welder ☐ Bantam Champ Welder. Send me ☐ Welder Catalog ☐ Electrode Catalog ☐ Accessory Catalog

Name _____ Position _____

Firm _____

Address _____

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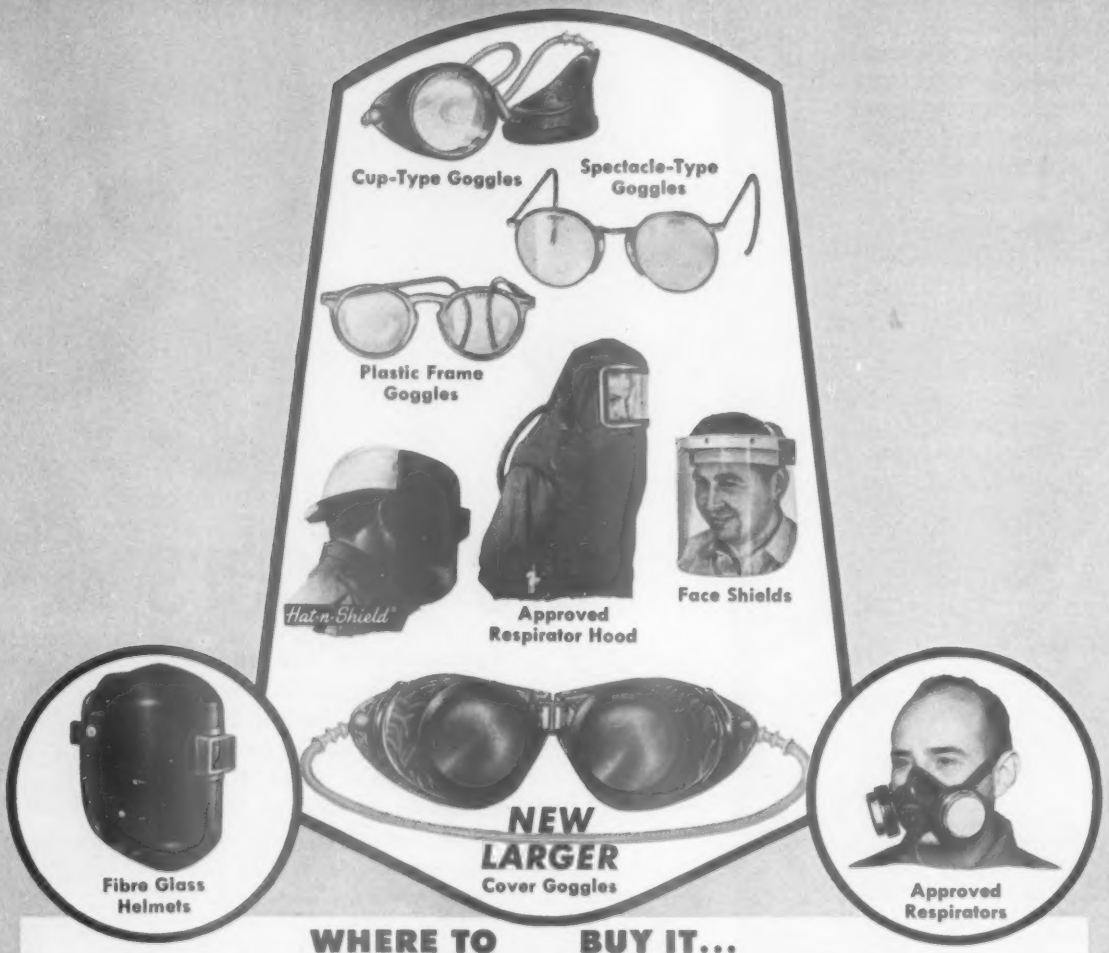

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THE WELDING ENGINEER

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VOLUME 38 NUMBER 3

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MARCH, 1953

Cover: *Weldor-in-a-cage is working on a heavy piece of marine equipment for the U. S. Navy at the Silver Engineering Works, Denver, Colo. See page 48.*

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GROUNDWORK

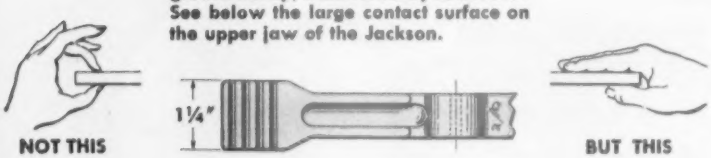
for Profitable Welding

Arc Welders must put on the heat. But only at one point: at the end of the electrode. And any heat elsewhere along the welding circuit means current wasted.

Don't rely on makeshift ground connections, inefficient and unwieldy C-clamps and plates, and on hastily made cable splices, ineffective and unstable.

Wherever connections must be made in the circuit, choose Jackson cable fittings which provide ample metal-to-metal contact to ease the flow, and stop the loss of current.

For greater metal-to-metal contact in a ground clamp, which would you choose? See below the large contact surface on the upper jaw of the Jackson.



JACKSON GROUND CLAMPS

When choosing between ground clamps, take a close look at the Jackson, and note the large, flat contact surface of the copper alloy upper tong. It provides the greatest and surest conductivity between the clamp and the work.

Other features: Simple, rugged design: the upper tong for contact, the lower for pinch. Greater leverage at the "handle" end of the tongs; they go easier *on*, easier *off*.

Recent improvements: New music wire coil spring . . . complete spring insulation at both ends against accidental arcing, and to prolong spring life . . . new, larger pivot bolt for greater strength, where it counts most.

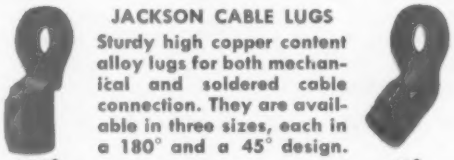
Double Economy: The Jackson Ground Clamp, eliminating loss of valuable welding current, will pay for itself in very little time. And because its price is low, you may be sure of *double economy* when you buy Jackson's.

JACKSON "QUIK-TRIK" CABLE CONNECTORS

The safest way of making cable extensions. By connecting the female unit to the cable lead, the live cable end is always well insulated when not in use. Units lock tight by a twist of the hand. To avoid delays in your shop, keep your stock of replacement holders on hand with a length of cable and a male unit of the cable connector fastened to them. Then, if a holder needs replacing, get a spare and connect it in a minute.

JACKSON CABLE SPLICERS

Cable ends make adequate metal-to-metal contact with the copper alloy splicer, clamped, soldered, or brazed. For permanent, well insulated extensions; time saving, economical.



JACKSON CABLE LUGS

Sturdy high copper content alloy lugs for both mechanical and soldered cable connection. They are available in three sizes, each in a 180° and a 45° design.

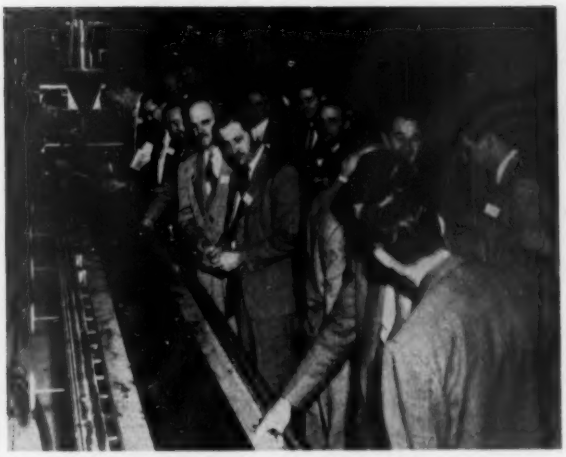
Please specify type required

See your Jackson Distributor for prompt delivery
Also ask him about Jackson Electrode Holders, Eyeshields, and Safety Goggles

JACKSON
PRODUCTS
WARREN · MICHIGAN

MODEL	CABLE SIZE	CABLE CONNECTION	CAPACITY	GROUND CLAMP		CONNECTOR	SPLICER	LUG
				jaw opening	price	price	price	price
No. 1	4 thru 1/0	mechanical or soldered	300 amp	1⅛"	2.75	2.95	1.60	.80
No. 2/0	1/0 and 2/0	mechanical or soldered	500 amp	1¾"	3.50	3.75	1.85	.90
No. 4/0	3/0 and 4/0	soldered only	500 amp	1¾"	3.25	3.50	1.50	.80

TWO PRODUCTION lines will start turning out electrodes in July at A. O. Smith plant at Lancaster, Pa.



NEW LINE of automatic welders (left, above) brings visitors to Sight Feed open house at West Alexandria, O.

NEWS

A. O. Smith Electrode Plant Going Up at Lancaster, Pa.

LATE July will see a new, ultra-modern electrode plant at Lancaster, Pa., built by the A. O. Smith Corp., Milwaukee. L. T. Hickey, manager of the A. O. Smith Welding Division, points out that the Pennsylvania site will save eastern customers substantial freight costs and speed delivery.

All A. O. Smith electrodes are now made at Milwaukee, where all nonproductive functions of the division will continue. The new 41,000 sq ft plant represents additional electrode-making space. Two complete production lines will begin at the mixing room and progress through packaging and shipping. The latest types of extrusion presses and drying furnaces will be installed to make production almost automatic, says A. O. Smith. Strict humidity control will be a feature of the coating and storage rooms, the latter with a capacity for several million lb of electrodes. At the outset the plant is expected to employ about 40 workers on a five-day week basis.

* * *

Bird Gas Corp. Bought by Liquid Carbonic

AN agreement has been reached with the stockholders of Bird Gas Corp., Detroit, for its purchase by The Liquid Carbonic Corp., Chicago. The transaction is on an exchange of stock basis and was subject to audit and final appraisal at this writing.

Bird Gas Corp. has been in business in Detroit since 1937 and is a principal producer of oxygen and acetylene in the area as well as a major distributor of welding equipment and supplies.

News Highlights

- National Cylinder Gas-Girdler Corp. plan merger. Page 6.
- New liquid oxygen plant for Airco. Page 78.
- Handy & Harman scholarship program. Page 78.
- Rocket Welding papers at Western Metal Show. Page 79.
- Magnesium Show expects 50,000 visitors. Page 82.

New Welders Shown at Sight Feed Open House

UNVEILING of a new Sight Feed automatic welding fixture was the occasion for the January open house held by Sight Feed Generator Co., West Alexandria, O. The "Rexarc" welding equipment became an addition to the Sight Feed line through acquisition of the Dean Weld Machine Co., Oakland, Calif. Dean Weld will now operate as a subsidiary with Carl F. Smith, Sight Feed President, as chairman and managing director of the west coast company. Business and industrial leaders from all over the country were present to see the new equipment. Features of the new equipment include provision for high or low voltage welding, high frequency starting and stabilization, control over low arc voltage and amperage, and extreme versatility in lineal or cross-bead work on flat or cylindrical shapes. The welding head is removable from one fixture to another. Applications include automatic hard-facing of tractor idlers, rollers, track-rails, crusher mandrels, sheaves and other earth-moving machinery components.

More Stainless Electrodes

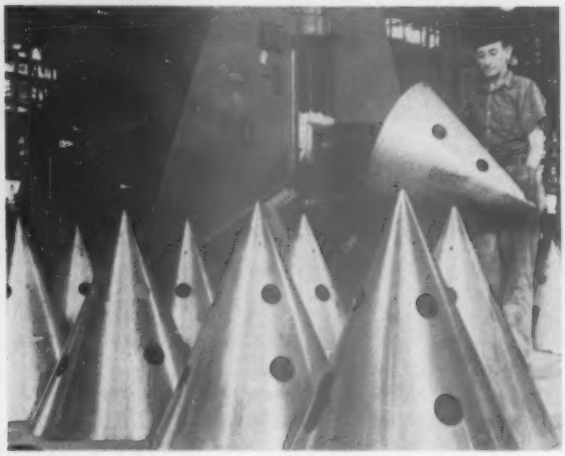
Cutbacks in the Army's tank program are expected to make available between 1,500 and 2,000 tons of stainless electrodes. Originally these were to go into tanks the first six months of 1953.

Most helped will be the people needing 18-8 and modified 19-9 electrodes. The unslackened jet program will continue to take large amounts of 29-9 and type 312 electrodes.

Overall defense demand for nickel is becoming greater. For civilians, there will be less nickel available next quarter than any time since mid-1952. An even more severe shortage would have occurred had the anticipated second-quarter nickel usage for guided-missiles, atomic energy and jet planes been up to 1953's first three months.

NEWS

from page 5



THREE-HORN rolling machine shapes stainless cones for J-47 jet engines at Firestone Steel Products Co.

25,000 STUDS welded to bridge's steel grid deck help hold black-top surface. Bare grid was slippery

National Cylinder Gas To Merge with Girdler Corp.

PLANS are underway for a merger of National Cylinder Gas Co., Chicago, and The Girdler Corp., Louisville, Ky. The boards of both firms have authorized their managements to go ahead with the plans, which involve a stock exchange. One share of The Girdler Corp. common will be exchanged for 3⅓ shares of NCG common. Stockholders of both firms will be asked to approve the plan at separate meetings to be held later in the spring.

National Cylinder Gas is a leading producer of oxygen, acetylene, and other industrial gases, as well as welding and cutting equipment. The Girdler Corp. is a major manufacturer of processing equipment for the chemical, food, textile and other industries. It also makes high-frequency heating equipment and designs and builds petroleum, gas and chemical plants.

Consideration of merger possibilities grew out of common ownership by the companies of Tube Turns, Inc., Louisville, pioneer manufacturer of seamless welding fittings and flanges.

* * *

Tail Cones Turned Out by Firestone Steel Products

left photo

A SPECIAL three-roll forming machine at Firestone Steel Products Co. turns out large quantities of stainless steel tail cones for J-47 jet engines. Other parts made there are turbine casings, inner and outer combustion chambers and exhaust cone assemblies.

Part of Firestone Tire & Rubber Co., Firestone Steel is the largest fabricator of stainless steel in the country and during World War II was the world's top producer of oxygen cylinders for high-altitude flying. Before converting to jet engine parts production, these facilities turned out stainless milk cans and beer barrels.

* * *

Plenty of Wood Flock For Future Electrodes

MATERIAL shortages that caused many World War II bottlenecks shouldn't occur again in event of an all-out emergency. Industry expansion goals have eliminated many possible trouble spots.

One source of an electrode shortage in World War II was the lack of twenty 1 to 5 hp electric motors in a small New Hampshire plant, Brown & Co.

The plant manufactured then, as it does now, a little-known product called wood flock (powdered wood), used in electrode coatings. Lack of the 20 motors stopped processing at the plant, which is the largest supplier of this material.

Intervention of the welding equipment section of WPB made it possible to get priorities to procure the motors.

At present three companies make ample supplies of wood flock in various parts of the Northeast. They are the Riordan Co., Montreal, Canada, Rayonier Inc., New York City and Brown & Co., whose home office is in Boston, Mass.

Stud Welding Helps Reduce Skidding on Deck Bridges

A NUMBER of serious auto accidents involving skids on steel deck bridges has brought up the problem of surfacing them for safe driving. The State of Illinois Highway Department has evolved a method of laying black top over steel mesh that is secured to the grid by stud welding.

The black top layer prevents ice forming on the grid, the major cause of accidents in fall and winter.

Resurfacing the 1,000-ft bridge over the Rock River at Grand Detour, Ill., six miles north of Dixon, took only nine working days, during which time at least one-half the bridge was always open to traffic.

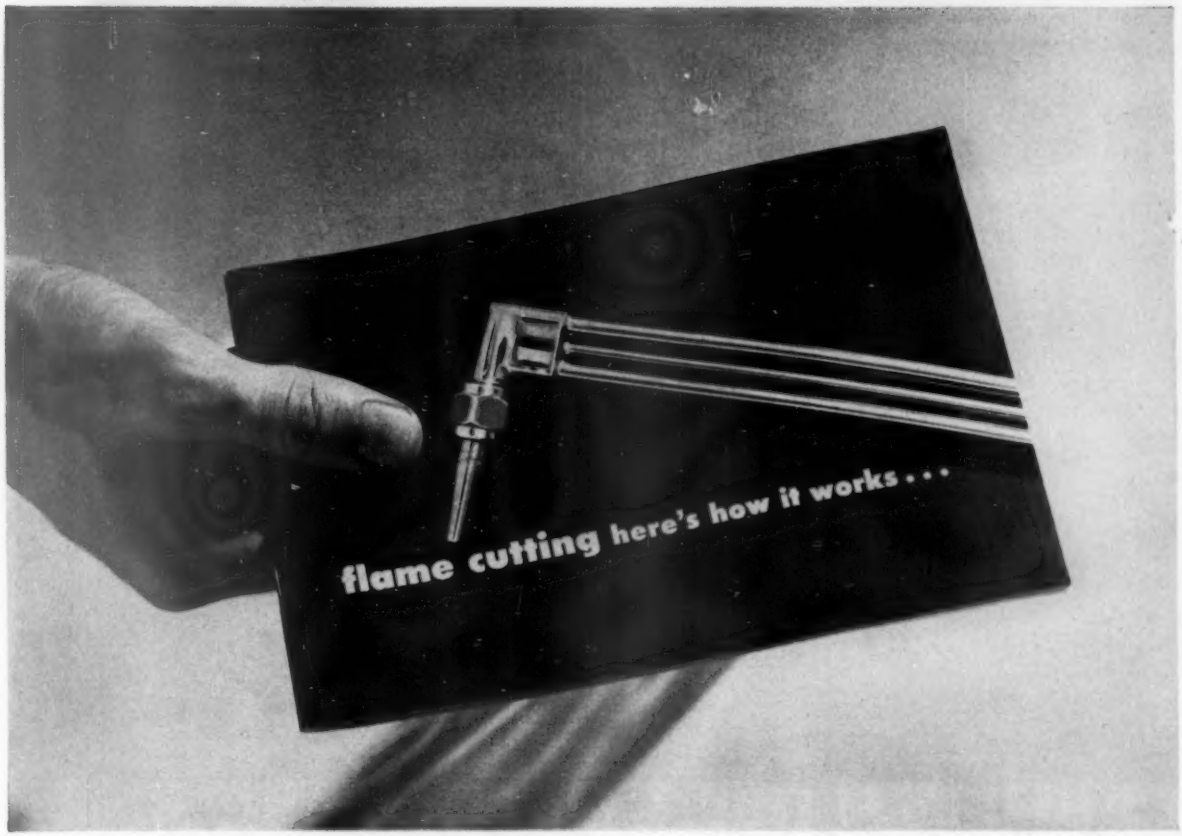
About 25,000 ½ by 1-in. annealed no-thread studs were end-welded to the steel grid on 12-in. centers, according to Nelson Stud Welding, Division of Gregory Industries, Inc. Heavy diamond steel mesh was impaled over the studs which were then bent over to hold the mesh in place. Studs were end-welded to the grids at the rate of 7,000 a day with four stud welding guns operated from two portable Nelson battery-operated power sources.

* * *

2,200 More Miles of Pipeline

THE Federal Power Commission has authorized construction of 2,232 miles of gas pipeline. The big welded pipes will add more than 1,200,000,000 cu ft of daily gas capacity to existing pipeline systems. Construction cost is estimated at $174,055,234.

(More News on page 78)



this is a really good book, you will want a copy of it . . . free, while supply lasts

This forty page brochure is packed full of important, interesting and worth-while information; 27 fine photographs illustrate the well written text. Here are some of the subjects covered:

What is flame cutting . . . why preheating flames . . . one or many preheating flames . . . how important is the oxygen jet . . . how much oxygen pressure do we need . . . does pressure dictate volume . . . which fuel gas to select . . . and full details about how a cutting torch is designed and how it functions.

There are hints on how to select a cutting tip . . . and much added data of value to the experienced operator as well as for the rankest beginner. It's a good book and you will want to own a copy of it. Write today for YOUR FREE COPY.

NATIONAL WELDING EQUIPMENT CO.
218 Fremont Street, San Francisco 5, Calif.
Please send FREE "Flame Cutting" Booklet.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

(Please print to make sure you receive your copy.)

925

Made by National SINCE 1910 WELDING EQUIPMENT CO., San Francisco 5, California

Crusher Jaws Rebuilt with Coast Metals Hard-Facing
REMAIN ON THE JOB AFTER 8 YEARS

CM-112 Hard-Facing Welding Rod Increases Jaw Life Per Facing 4 to 1

A large southern mineral company has found the way to keep these crusher jaws on the job year after year. It rebuilds them with Coast Metals Alloy No. 112.

The jaws are used for crushing feldspar. They operate, on an average, 8 hours per day, and crush approximately 22,000 tons annually.

Despite the rugged nature of the operation they handle, and the volume of material processed, these jaws are giving as efficient service today as when they first went to work 8 years ago. Not only has over-all jaw life been greatly increased, but, with CM-112, working surfaces *need only be coated 3 times a year*—in contrast to 12 times previously.

Many other hard-surfacing materials have been tried by the mineral company, but results achieved by CM-112 have proved *outstanding.*

Let us show you how CM hard-facing alloys can meet your requirements. Whether it be bucket teeth, crusher teeth, muller tires, augers—or any other part that must withstand severe wear and tear—and you'll find coating with CM specialized weld rods results in *many times the production obtainable from unfaced units.*

So don't *replace—reface* with CM Alloys. You'll minimize downtime, slash maintenance costs, keep your production running smoothly, step up your output.

COAST METALS, Inc.
Little Ferry, N. J.

COAST METALS (CANADA), LTD., Hamilton, Ontario

PRODUCERS OF SPECIAL HARD-FACING ALLOYS FOR THE ROCK PRODUCTS INDUSTRY

After Amscoating with Thermalloy 4, these Piercer Guide Shoes reduced down time and kicked production up.

Composite shear blade of mild steel base metal, hardfaced with Thermalloy 4 on cutting edge. Lower view: part after machining.

Hot trimmer die and punch Amscoated with Thermalloy 4 increased service life, cut costs.

BEAT HEAT WEAR and IMPACT with AMSCO THERMALLOY 4

If you have a wear problem involving high temperatures and requiring resistance to impact, this new Amsco hardfacing electrode can save you time and money

Elevated temperatures are tough to cope with in situations involving thermal shock, metal-to-metal wear, hot gas corrosion, high temperature oxidation—especially when you need great impact resistance. Here's where Amsco Thermalloy 4 can step in and give you longer service life, and big savings in time and money.

Supplied as both a composite coated electrode for electric welding or as a bare cast rod for gas welding, both types deposit a high-carbon stainless alloy containing chromium and nickel as the principle alloying elements. In many applications, it can replace expensive nickel base alloy materials. Thermalloy 4 is packaged in 50-lb. boxes or in 10-lb. packages in 50-lb. boxes. For detailed analyses and other pertinent information, write for catalog sheet on Thermalloy 4 or contact your nearest Amsco distributor.

AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
382 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

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Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

FOR LOW HYDROGEN ELECTRODES

Weldrod coatings with TAM Ruflux T increase the speed with which a slag sets up while providing better slag control. Ruflux T is a compound containing approximately 91.5% ZrO and 5.4% SiO_2. Mesh size is approximately 0.1% on 325 mesh. Detailed information is easily obtained by writing our New York City Office.

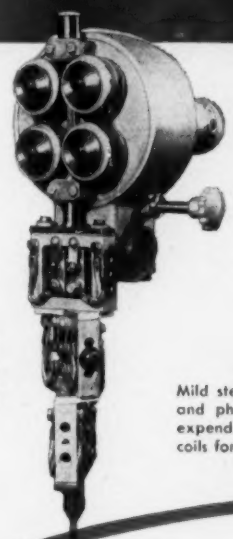
*TAM and RUFLUX are registered trademarks.

TAM PRODUCTS
Registered U. S. Pat. Off.

TITANIUM ALLOY MFG. DIVISION
NATIONAL LEAD COMPANY

Executive and Sales Offices: 111 BROADWAY, NEW YORK CITY
General Offices, Works and Research Laboratories: NIAGARA FALLS, N. Y.

Every Welding Need

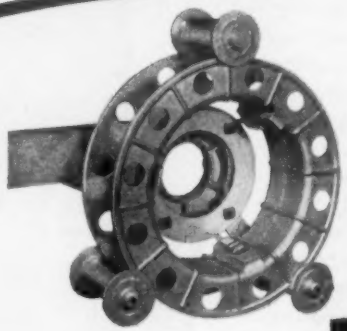


The Reid-Avery type 4R automatic head and control originally designed for Raco composite type A, may be used with equal success for lightly coated open arc or for submerged arc welding.

Raco composite type A heavy coated automatic (open arc) electrodes, a "Reid-Avery" first, can be furnished for all mild steel, low alloy high tensile, low hydrogen, hard surfacing and stainless steel grades.

Mild steel, alloy steel, stainless steel, aluminum and phosphor bronze wire are available on expendable wooden spools or in layer wound coils for gas shielded arc welding.

The Raco "free wheeling" reels are especially designed for high speed automatic machines. The ball bearing trunnions enclose the coil so there is no over-run or loose strands and larger coils can be used. Changing coils is a matter of only a few seconds and no tools are required. Available in 12, 14, 25 and 36 inch sizes, for any weight from 50 to 200 lbs.



The Raco coils of wire for submerged arc welding have long been known for their uniform high quality and convenient, easy to handle package. Special attention is paid to the accurate weight, lay and temper of the wire so that the wire will accurately follow a seam. Available in mild steel, alloy steel and stainless steel.

Since 1919 Reid-Avery Company has specialized in the manufacture of all types of welding electrodes and wire. The large modern plant in Baltimore is equipped for wire drawing, annealing, pickling, coating, cutting, winding and packaging. Every phase of welding electrode and wire production is completely controlled from start to finish. You can be assured of uniform high quality and the best possible deliveries.

We also manufacture a complete line of manual electrodes in the following grades:
Raco Mild Steel, Raco Low Alloy High Tensile, Racocast for nonmachinable welds on cast iron, Raco Feral for welding aluminized sheets, Raco Low Hydrogen, Raco Hard Surfacing, Racolloy Stainless, Racolloy Nickel and Nickel 60 for machinable welds on cast iron.

The REID-AVERY COMPANY
INCORPORATED
DUNDALK • BALTIMORE 22 • MARYLAND
SINCE 1919 PRODUCERS OF ARC WELDING ELECTRODES AND WELDING RODS

Aerofin Corporation is saving thousands of dollars here

with Phos-Copper® Brazing

By simply switching to Westinghouse Phos-Copper, the Aerofin Corporation is now saving thousands of dollars each month in purchasing costs alone. The use of Phos-Copper also assures strong, ductile bonds between Aerofin's intricate metal components in large air handling equipments. The Westinghouse alloy has been especially effective in brazing return bend sections of cooling units . . . it does the job *better* and *faster* than the more expensive silver alloys previously used.

Westinghouse Phos-Copper requires no flux on copper joints. It can be brazed at a temperature as low as 1350 degrees F. The high fluidity and excellent wetting properties of this economical alloy assure strong, flexible bonds capable of withstanding repeated shock and vibration.

Start enjoying Phos-Copper's important savings today. Call your nearest Westinghouse Office, or just fill out and send in the attached coupon for additional information. J-21715

The Aerofin Corporation uses Phos-Copper for the brazing of return bend tubing in the manufacturing of air handling units.

Westinghouse Electric Corporation
Welding Division
Box 868, Pittsburgh 30, Pa.

Please send me Booklet B-5454 on your brazing alloys, Phos-Copper and Phos-Silver.

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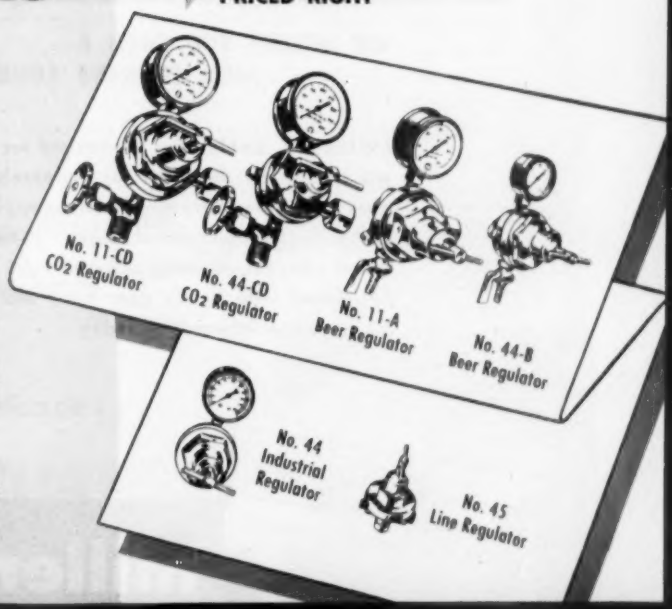

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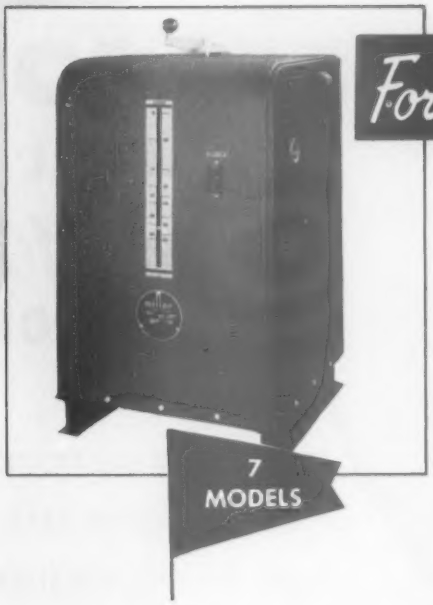

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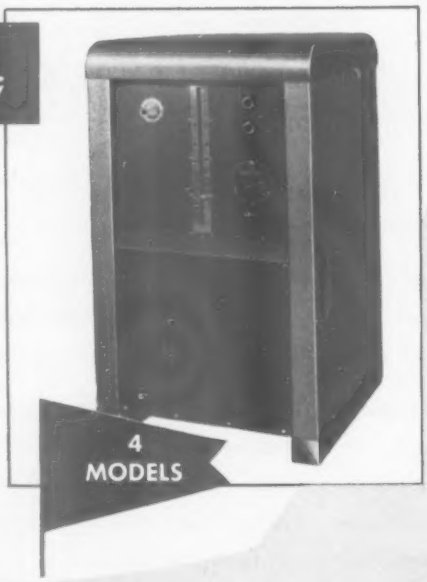
OR WHERE YOU NEED A HIGH CURRENT SOURCE

MILLER A.C. welders for submerged arc process are specifically designed for extremely heavy duty manual welding and for other applications demanding a high current source . . . two open circuit voltages, 80 volts and 100 volts . . . coil positioned with heavy gear head motor. Ask for complete information today.



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Welding 2¼ in. x 2¼ in. x ¼ in. galvanized angle iron frame with 3/16 in. Everdur-1010 Welding Rod.

EVERDUR* Rod and HELIARC* Welding

...the right combination for welding galvanized angle iron frames

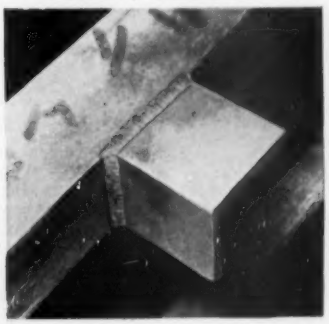
These galvanized angle iron frames are used to support air conditioning coils in the new Prudential Insurance building in Houston, Texas. Welding on the frames was done from both sides of the 2¼ in. x 2¼ in. x ¼ in. angles, laying a comparatively small bead. Leaving a 1/16 in. gap between the legs allowed the Everdur-1010 Welding Rod to "tin" more than halfway through the thickness of the angle. The arc cone was directed as much as possible on the Everdur weld deposit resulting in a minimum disturbance of the galvanized plating. Straus-Frank Company, welders in Houston, Texas, tested the efficiency of the joint by attempting to shear an angle clip (as shown in the lower right hand photograph) from the frame with a four-pound hammer. The legs of the angle were pounded flat—but no failure in the weld area occurred. ANACONDA Rods for every type of welding are available from distributors throughout the United States and Canada. For complete information on ANACONDA Welding Rods *plus* tips on practical welding techniques, send for Publication B-13. Address The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

*Reg. U. S. Pat. Off.

52177

Here is the finished frame used to support cooling coils in the New Prudential Insurance building, Houston, Texas.

Close-up of Everdur weld joining an angle clip to the frame.



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ANACONDA

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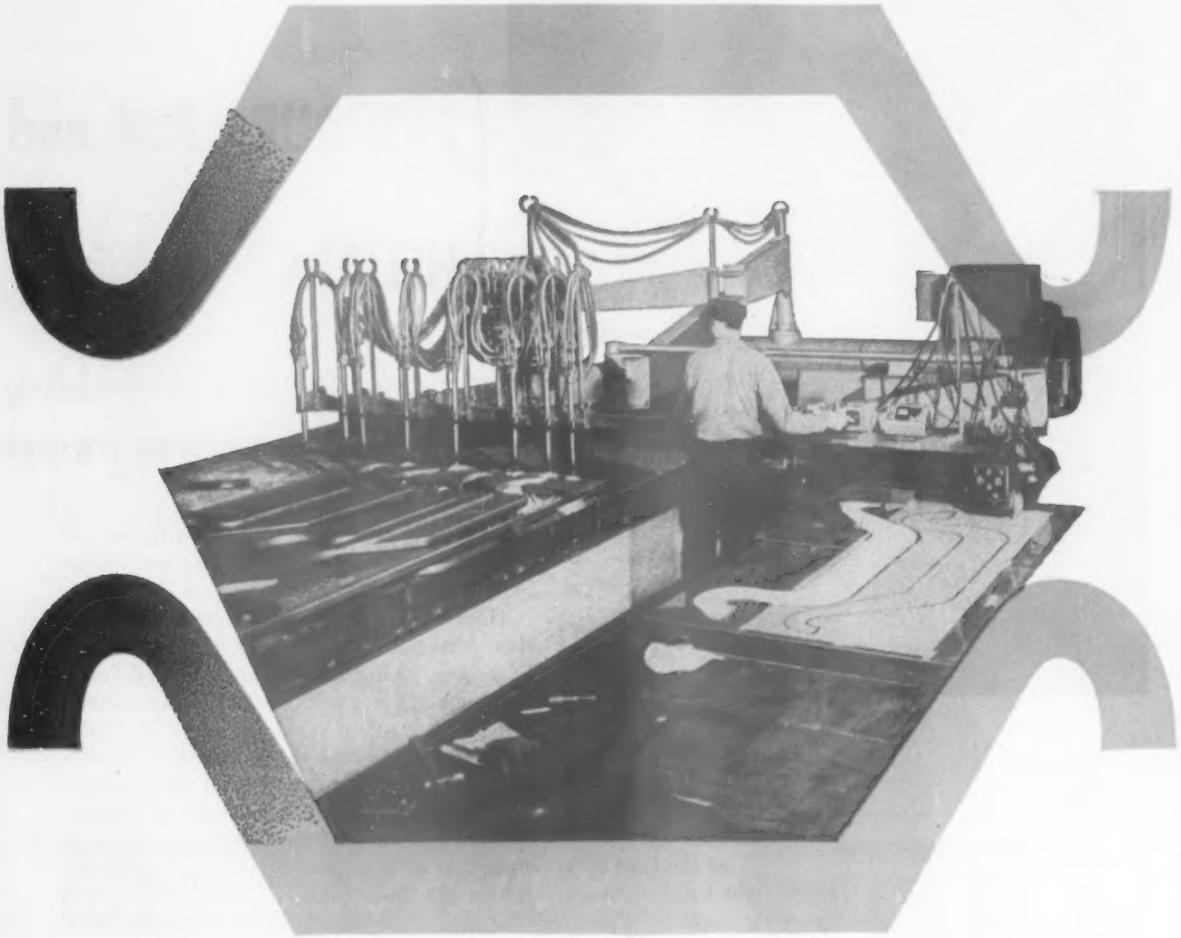

THE AIRCO NO. 50 TRAVOGRAPH mass produces yoke-shaped equalizer bars for diesel locomotives... to a 1/16" tolerance! Torches are automatically guided by an electronic tracer following a low-cost, pen-and-ink drawing... as four bars are cut simultaneously from 1½" mild steel, hot rolled plate. The versatile Travograph may be used for straight cutting, beveling or squaring... for circles up to 12 feet in diameter... or for straight lines of any desired length by adding extra sections of rail. Intricate shapes... cut to specification... with precision!

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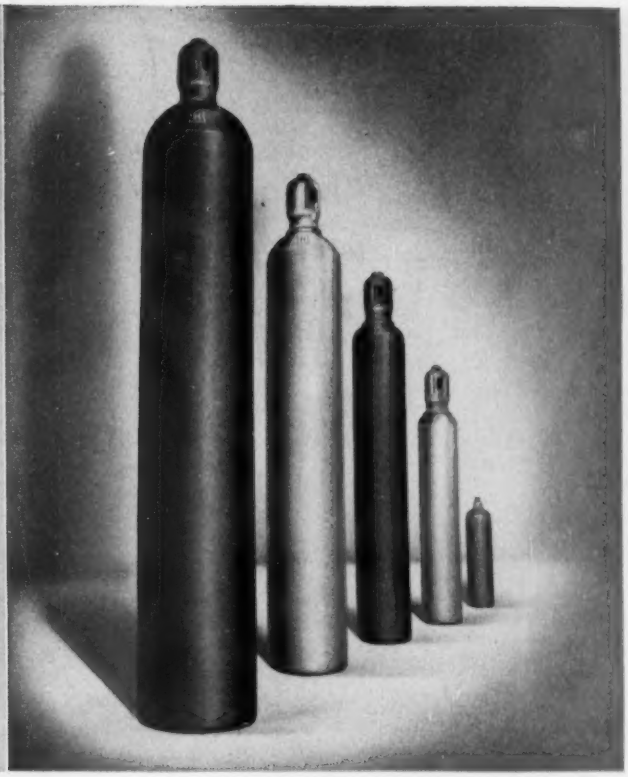

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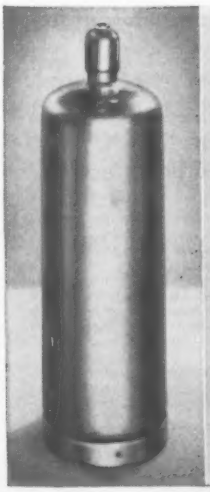
All cylinders are *not* alike . . . much as they may appear so to the casual eye. Into every Harrisburg seamless steel cylinder for high-pressure gases is built all the knowledge . . . all the experience . . . all the precision manufacturing "know how" of the world's largest producer of cylinders built to I.C.C. Specifications. They're just as good as they look! So . . . next time you buy high-pressure gas cylinders . . . buy from Harrisburg Steel. Choose from a complete line, a complete range of sizes, capacities, and both domestic and export types . . . 14 to 400 cubic feet. *Write for literature and prices . . . today!*



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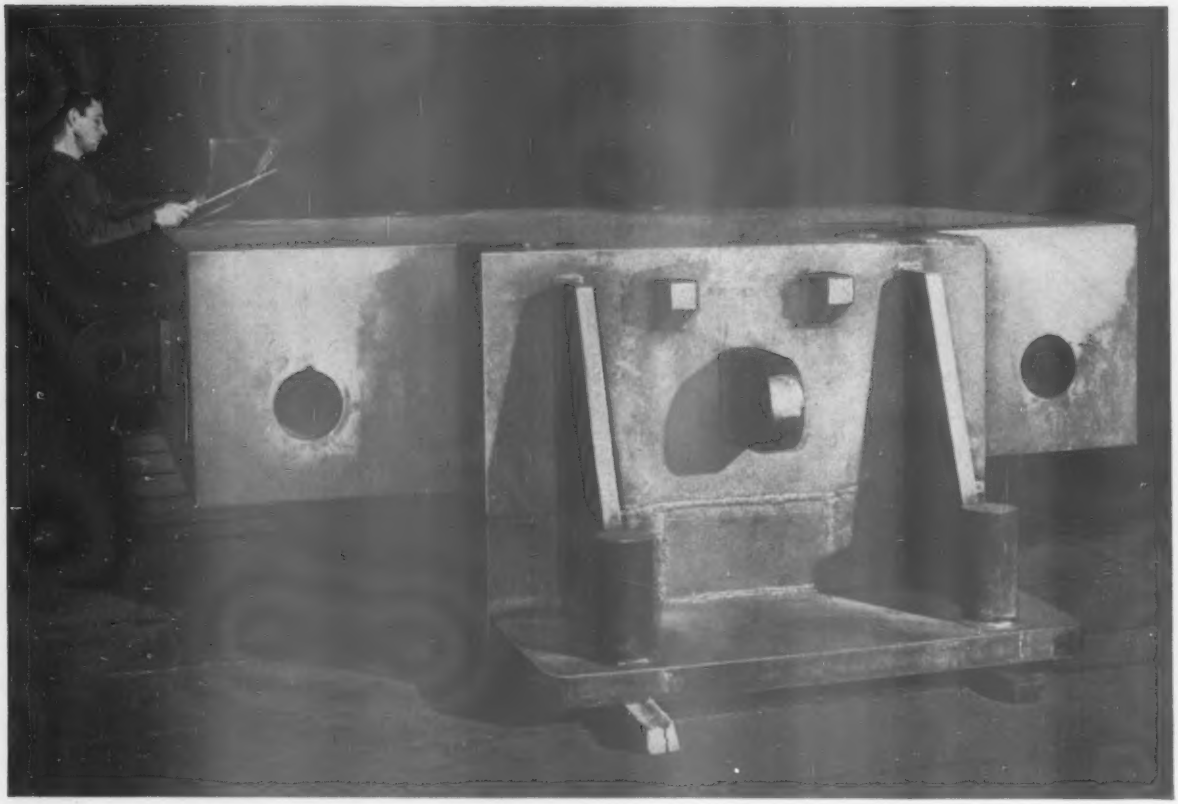


This 52-ton Weldment is Base for Forging Press

Designed to support a 1000-ton forging press, this weldment was formed by combining forgings and plate steel. It is 152 in. long, 123 in. wide, and 43 in. high, and weighs 103,673 lb. It was made in Bethlehem's Weldments Shop.

If you require bases, frames, perhaps an entire press, or some other type of manufacturing equipment or parts, the chances are good that your needs can be met economically, either wholly or in part, by using Bethlehem Weldments.

ADVANTAGES OF BETHLEHEM WELDMENTS

1. Bethlehem Weldments eliminate excess weight, without any sacrifice in rigidity. This frequently leads to a reduction in manufacturing cost for the finished product.

2. They are versatile, for they can be made in a wide size-range, either as simple parts or intricate assemblies.

3. They offer greater latitude in product design, for the steel from which they are made can be bent, pressed or otherwise shaped prior to welding.

4. They can be used alone, or can be combined effectively with forgings or castings.

★ ★ ★

If you would like additional information about Bethlehem Weldments, the nearest Bethlehem office is at your service.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

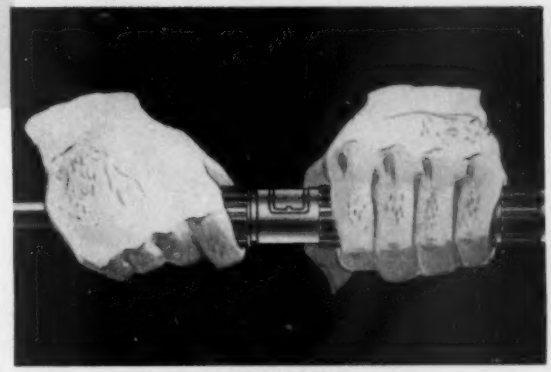
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

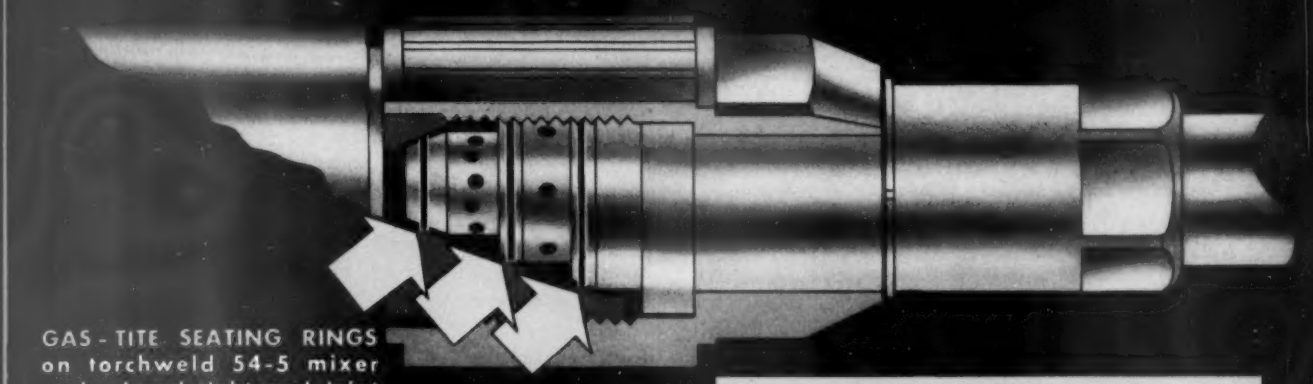
BETHLEHEM WELDMENTS

BETHLEHEM STEEL

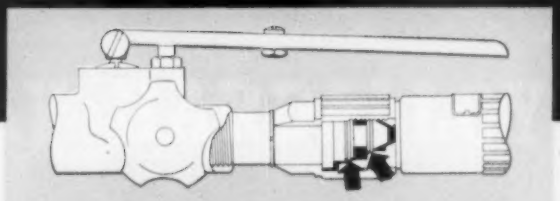
GAS-TITE

NEW TORCHWELD SEATING RINGS PERMIT GAS-TIGHT JOINTS... *with HAND-TIGHTENING*





GAS-TITE SEATING RINGS on torchweld 54-5 mixer make hand-tightened joint leakproof. Made of tough, long wearing Servene in flat, gasket design—won't roll off.



- **QUICK COUPLING OF TIPS AND MIXER**—no wrench needed.
- **POSITIVE LEAKPROOF SEATING** even in dusty or sandy atmospheres — without damage to metal seating surfaces.
- **LONGER MIXER LIFE** — Servene seats take all the abuse, are easily and quickly replaced when necessary.
- **LOWER MAINTENANCE COSTS** — eliminates costly periodic re-seating of torch heads.
- **INTERCHANGEABLE DESIGN** — fits any Torchweld No. 54 welding torch handle.
- **LONGER TORCH LIFE** — perfect, gas-tight seal is achieved without strain on threads or seating surfaces.
- **LOWER REPLACEMENT COSTS** — you replace the seating rings, not the entire mixer.

TORCHWELD 58-1 CUTTING ATTACHMENT

For use with No. 54 torch handle

A twist of the wrist and the 58-1 cutting attachment is securely coupled to any Torchweld No. 54 handle. Its newly designed connector plug has Torchweld GAS-TITE seating rings to make a leakproof seal despite condition of seating surfaces. Has features of the heavy-duty No. 75 Torchweld Cutting Torch, including forged bronze head, triangular tube construction and diaphragm type valves.

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LINDE'S News of Metalworking

New Machine Carriage Saves Time On Many Jobs

A new machine carriage in the low-priced field does dozens of metalworking jobs—and does them more quickly, accurately, and uniformly than the most skilled hands. This machine, the OXWELD CM-45, handles practically all machine carriage requirements in small metalworking shops, and supplements heavier equipment in larger plants, shipyards, and mills.

Used on track, the CM-45 is ideal for accurate straight-line cutting. It also cuts top or bottom bevels at practically any angle. With standard radius rods, it cuts circles with diameters of from 2 to 54 inches. To cut larger circles, a longer radius rod can easily be substituted.

Flame-treating work—be it flame-hardening, flame-softening, or low-temperature stress relieving—requires precisely controlled heat. With the CM-45 and appropriate heating apparatus, you get just that; thus you can be sure that each of your flame-treating jobs will be done uniformly.

These are only a few of the jobs that the OXWELD CM-45 Machine Carriage will do for you. Many additional cutting, welding, and heating applications will be suggested by the requirements of your own shop.

The CM-45 saves you time, not only because it does each job efficiently, but also because it is so easy to set up and operate. There is no complicated machinery to master. Its simple design makes it easy to adjust or repair. All parts are readily accessible.

Operating controls consist of a speed-control dial that can be preset or adjusted at any time, and a two-position clutch lever. All controls are grouped together at the rear of the machine for your convenience.

Since the machine weighs only 33¾ lb. complete with cutting blowpipe (as shown in Fig. 1), it's an easy, one man job to move it from one section of your shop to another. The machine's compactness also makes it convenient for use in close quarters where larger machines cannot be used.

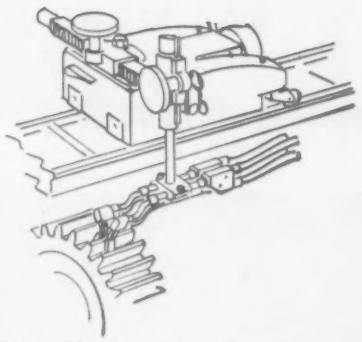

Fig. 2—Flame-treating work requires precise control of applied heat. The CM-45, with suitable apparatus, assures you of efficiency and uniformity on every job.

Any LINDE representative will gladly show you how the OXWELD CM-45 Machine Carriage will help you turn out more work in less time. Call the nearest LINDE office today for a free demonstration.

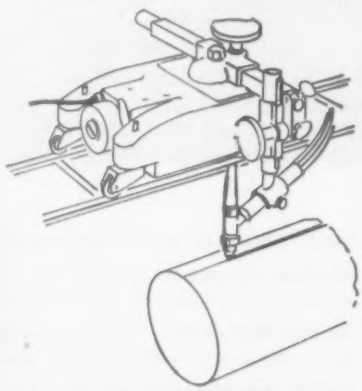

Fig. 3—Do special welding jobs, such as tube fabrication, quickly with the CM-45. Rejects are reduced to a minimum.

Fig. 1—Cut straight lines or bevels in plate or other steel forms. For all the CM-45's many jobs, a stepless speed range of 4 to 32 in. per min. is available.

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Welding Arcs

REPORTS FROM WELDORS ON JOBS LIKE THESE INDICATE THAT NEW GENERAL ELECTRIC TYPE W-610-A

Now—Better Welds Faster with G.E.'s

Pipelines, shipyards, fabricators, and builders report many benefits from new AWS Class E-6010 electrode:

PIPELINES Operators like W-610-A electrode because it's easier to use and produces top-flight welds. Slag is easy to remove and "pinholing" is not a problem. The coating does not break down even at high currents. X-rays show excellent deposits and very low porosity.

SHIPYARDS "Now you've got something," say shipyard weldors. On overhead butt welds—one of the toughest shipyard jobs—W-610-A is free of "fingernailing" and "wandering arc." No trouble is caused by reaction pitting. Good set-up prevents undercutting.

FABRICATORS "This is really it! Gas pockets are practically a thing of the past." Weldors prefer the new W-610-A over any other Class E-6010 in the shop. Even on dirty, rusty steel, this new G-E electrode is easy to use. And burn-off rates are high, increasing production.

CONSTRUCTION Weldors welcome the new W-610-A because it's easy to use in all positions and its ability to take high currents speeds construction.

Users have backed up these reports by placing large orders for W-610-A for immediate shipment. But don't take our word on the new W-610-A—find out for yourself. General Electric Co., Schenectady 5, N. Y. 710-4

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GENERAL ELECTRIC

News

Information on equipment, electrodes and accessories from G.E., pioneer in arc welding

ELECTRODE WILL BE INDUSTRY'S NEW QUALITY STANDARD

New W-610-A Electrode

TRY NEW W-610-A YOURSELF at our expense

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Why not try this new W-610-A electrode on your toughest mild-steel jobs? Just ask for a free sample from your nearby G-E Welding Distributor. You'll find his name here, and also in the yellow pages of your phone book under "Welding Equipment—General Electric." Contact him today.

Here's the name of your G-E Welding Distributor—

Alabama: Birmingham—Alabama Oxygen, Young & Vann Supply; Mobile—Turner Supply

Arizona: Phoenix—Consolidated Welding Supply

California: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, Ventura—Victor Equipment

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Idaho: Boise—Olson Manufacturing

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BUTTERING WAS THE ANSWER!

Saved costly casting . . .

allowed use of low cost rods

Need for complete re-making of a large, costly composite machine frame threatened a prominent Western mining equipment builder. Weld metal was picking up harmful impurities from the cast part—it was impossible to obtain satisfactory welds using the electrodes specified.

The local M&T salesman joined with company welding engineers . . . experimented . . . and sparked a solution! On his advice surfaces of the casting where welding was required were simply "buttered" with Murex Type HTS before the bulk of the weld metal was deposited.

Results were: complete elimination of pickup so that remaking of the casting to new metallurgical specifications became unnecessary. And, the specified electrodes, on hand for the job, could be used.

Your nearby M&T representative is qualified to give you expert assistance on any welding problem. Call on him when you need help. Make use of his broad background of experience in every phase of welding.

MUREX®

Electrodes

Arc Welders • Accessories

METAL & THERMIT CORPORATION 100 East 42nd Street, New York 17, N. Y.

30 YEARS IN THE WELDING FIELD

is a long, long time!

In many industries, a span of 30 years is a "short" length of time. But, in welding, the three decades after 1923 represent the great period of growth in this field—a span that might equal hundreds of years in another industry. For in this period preceding and following World War II, welding has come to the forefront as a superior method of fabrication. Through its exclusive qualities, its developments, its limitless applications, welding has contributed speed, power, strength, and stupendous savings in time, labor and materials to the products of the metal working industry.

In this period, we have seen the construction of all-welded ships, welded buildings, welded airplanes and many other modern-day welded wonders. In this era, the welding industry has grown out of its swaddling clothes into a giant of unlimited capacity and utility.

Burdett, celebrating its thirtieth anniversary, has grown step by step with the industry, developing products and facilities to meet new requirements. From five to five hundred employees... from one to over one thousand different products is a measure of our growth, but more than that it signifies the spirit of service upon which this organization was founded. Young in years, old in experience, Burdett faces the future with confidence, knowing that welding has shown the world only a small sample of the work of which it is capable.

every product... and every process... to fit every purpose best!!

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GRINDING—Important tips on grinding and finishing of stainless steel.

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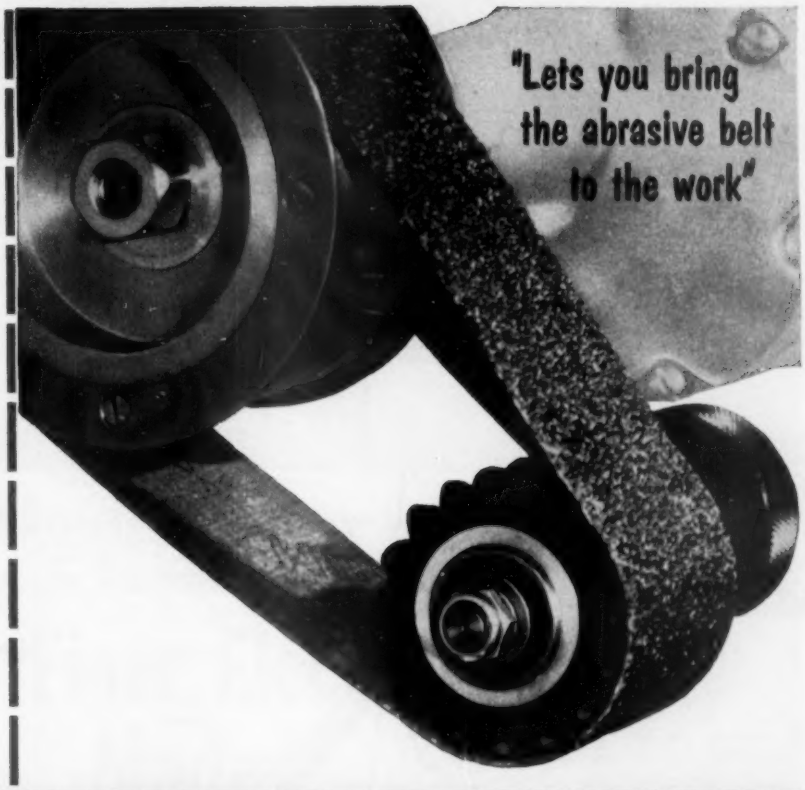
Grind FASTER with BELTS ...at less cost!



2 NEW MODELS "61" Port-A-Belt GRINDING ATTACHMENTS

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Yes! I'd like to know more about the "61" PORT-A-BELT Grinding Attachments.

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...after nine years steady use

STANDARD STEEL TREATING CO.
Harris Calorific Sales Co.
7401 Dubois Street
Detroit 11, Michigan
Gentlemen:
We thought it might be of interest to you to know that after nine years steady use we find it necessary to finally replace one of our #18 Harris Automatic Torches.
This torch is one of a number of this type in use in our straightening department and we can state without reservation that all have given exceptional service at practically no maintenance expense except for tip replacement.
Very truly yours,
STANDARD STEEL TREATING CO.
James D. Thompson, Gen. Mgr.

practically no maintenance expense...

To the advantages named in Mr. Thompson's unsolicited letter, important as they are, we must add another that might not be obvious to those who have never used a Harris Automatic Torch. That is, in nine years of continuous operation the thumb control lever (circled at right) must have been actuated many thousands of times. Each and every time it saved money. Using it to restore the full flame from pilot light eliminates the time, motions and gases wasted in flame adjustment of a standard torch. Using the thumb control to shut off the full flame saves oxygen and acetylene that is wasted when the full flame burns but is not applied to work. All these things combine to yield a tremendous return on torch investment.

Harris Distributors, located in all principal Cities, are at your service. There's no better time than now to act!

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Alloy Rods Co.

LOOK FOR THE FLAMING ARC TRADEMARK

ALLOY RODS COMPANY

The Leading Manufacturer of Alloy Arc Welding Electrodes

PRESENTS

THE FIRST "INSIDE STORY" FILM

OF HOW ARC WELDING ELECTRODES ARE MADE

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MADE INSIDE ALLOY RODS' YORK, PENNSYLVANIA PLANT

Never before to our knowledge, since arc welding became of age as a major fabricating tool for American industry in the early 1930's, has any electrode manufacturer permitted the public to see how coated arc welding electrodes are made. The manufacturing processes and procedures have always been carefully guarded trade secrets.

Now, for the first time, *Alloy Rods Company* has filmed its entire manufacturing process in the interests of better trade relations and technical understanding... from the cold drawing of hot rolled rod to the packaging of its finished electrodes in moisture-proof metal containers. You can now see how arc welding electrodes are made.

"No Finer Electrodes Made... Anywhere" is not a sales film or promotional tool. It is technical and instructional.... shot on the production lines and in the laboratories ... to show those interested in better arc welding *why* we make electrodes this way. Prints of this film are available, without charge, to any reputable organization or institution.

WRITE, WIRE, OR TELEPHONE to Department M if you would like to use this film for any organizational or educational purpose. We will try to have a print available to fit your next open date.

ALLOY RODS
COMPANY
YORK, PENNSYLVANIA

NO FINER ELECTRODES MADE ANYWHERE

AR-12

WESTERN PREMIERE • At the Western Metal Exposition, Pan-Pacific Auditorium, Los Angeles . . . March 23-27, 1953 . . . Alloy Rods Company Exhibit . . . Space 105 . . . Showing Every Hour on the Hour.

Now . . . Seams Reduced to **ABSOLUTE MINIMUM** on these NEW AO Gloves!

HAND PROTECTION

AO 514 ASBESTOS GLOVE

Yes, for workers' comfort . . . for savings for our customers, we've redesigned our asbestos glove line to eliminate seams wherever possible. By reducing seams from 8 to 3, there's not only greater working ease for the user but longer work life for the glove.

MAKE THIS COMPARISON TEST!

Look at any conventional asbestos glove. Note the vertical seams that extend to the cuff. Note the seams that secure gauntlet to glove. Now check against the large photograph here. You'll see the seams on the thumb and only ONE SEAM extending the length of the glove (on the back). Note also the absence of horizontal seams—(thus assuring a stronger glove and longer life which means valuable savings).

AO 1514 Glove with leather-reinforced palm.

AO 2514 Glove with asbestos-reinforced palm.

AO 3514 Glove with full leather-reinforced palm and finger area.

QUICK FACTS:

- Finest grade specially treated asbestos, recommended for extreme heat.
- Yarn is closely woven.
- Double stitched for long service.

AO's Industrial Vision Program increases production, decreases accidents. Write today for free booklet "Improved Industrial Vision" to 1113 Vision Park, Southbridge, Massachusetts.

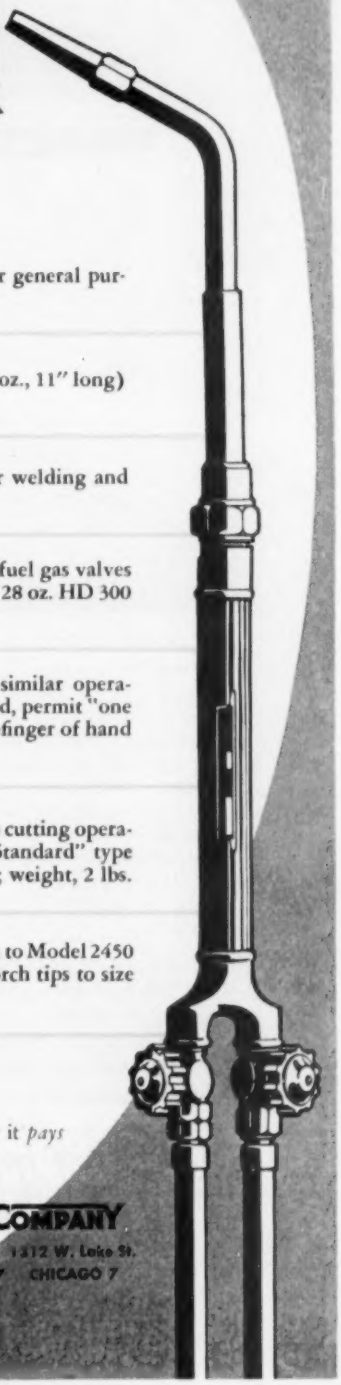
American Optical
SAFETY PRODUCTS DIVISION

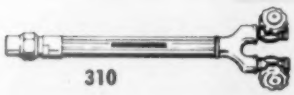
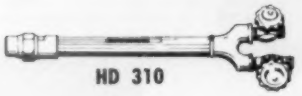
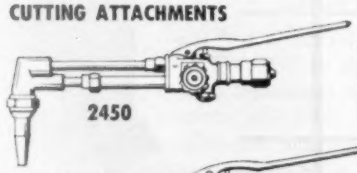
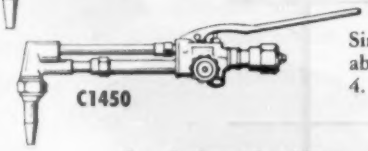
SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

Which of these most popular models

by VICTOR

best fits your needs?



300 SERIES WELDING TORCHES	DESCRIPTION, APPLICATIONS
315	A compact 18-oz., 9-inch torch ideal for general purpose welding and cutting.
 310	A medium weight and length torch (21 oz., 11" long) for all around use.
300	A long (14") torch for users of larger welding and heating nozzles; weight 24 oz.
 HD 310	Heavy duty models with high capacity fuel gas valves for large gas flows. HD 310—11" long, 28 oz. HD 300—14" long, 32 oz.
P 310	Especially designed for pipeline and similar operations. Gas control valves, at forward end, permit "one hand" adjustment with thumb and forefinger of hand holding torch. 9" long, 22 oz.
CUTTING ATTACHMENTS	
 2450	Handles a full range of general purpose cutting operations up to approximately 8". Uses "Standard" type cutting tips up to size 5. Length is 13"; weight, 2 lbs.
 C1450	Similar in size, weight and construction to Model 2450 above, but designed for smaller "C" torch tips to size 4. Cuts to approximately 6".

Look for the Victor dealer sign!

—Ask him to show you why it *pays* to standardize on VICTOR.

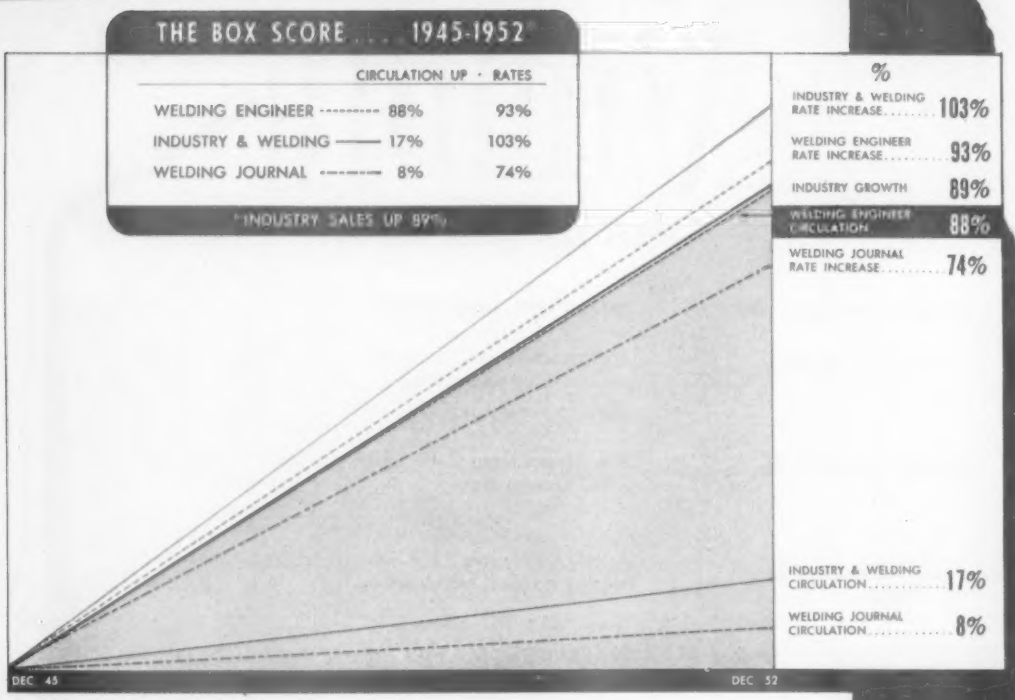
Dealer Inquiries Invited VICTOR for welding

VICTOR EQUIPMENT COMPANY

3821 Santa Fe Ave. 844 Folsom Street 1312 W. Lake St.

LOS ANGELES 58 SAN FRANCISCO 7 CHICAGO 7

PAID CIRCULATION THAT KEEPS ABREAST OF THE WELDING INDUSTRY'S GROWTH

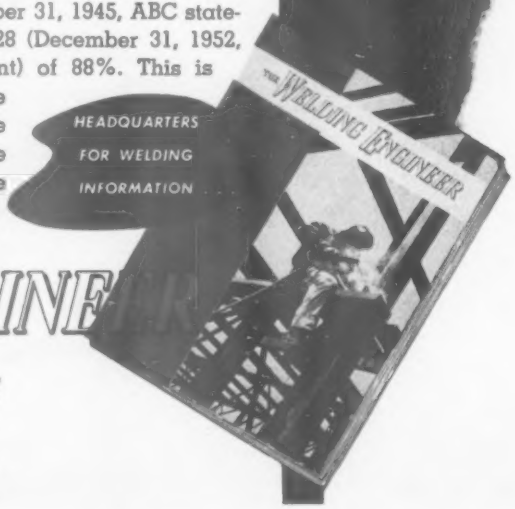

THE BOX SCORE . . . 1945-1952
CIRCULATION UP · RATES
WELDING ENGINEER ---------- 88% 93%
INDUSTRY & WELDING —— 17% 103%
WELDING JOURNAL ------- 8% 74%
INDUSTRY SALES UP 89%
%
INDUSTRY & WELDING RATE INCREASE..... 103%
WELDING ENGINEER RATE INCREASE..... 93%
INDUSTRY GROWTH 89%
WELDING ENGINEER CIRCULATION 88%
WELDING JOURNAL RATE INCREASE..... 74%
INDUSTRY & WELDING CIRCULATION..... 17%
WELDING JOURNAL CIRCULATION..... 8%
DEC 45
DEC 52

• The welding market is expanding! Since the end of the war it has accelerated far more rapidly than average, far more rapidly than the average of industry generally. The sales of welding equipment, supplies and gases from 1946 to 1952 have increased 89%, but now it is even faster —between 1949 and 1952 the increase was 66%. Such growth forecasts a tremendous future for the welding industry.

The circulation of THE WELDING ENGINEER has kept pace with the expanding market—and the space rate increase of THE WELDING ENGINEER has been in keeping with the circulation increase.

In short, you pay for what you get with THE WELDING ENGINEER—circulation increase matching industry growth, and circulation where the market possibilities exist.

Since the end of World War II the ABC paid circulation of THE WELDING ENGINEER has increased from 9,972 (December 31, 1945, ABC statement) to 18,728 (December 31, 1952, ABC statement) of 88%. This is five times the percentage growth of the next magazine in the field.



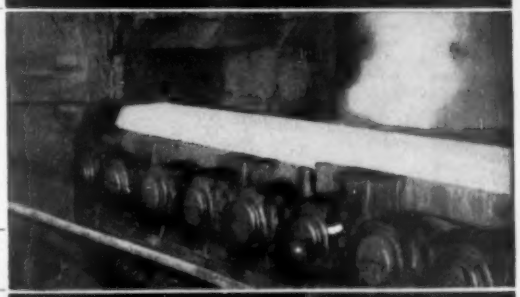
THE WELDING ENGINEER

330 WEST 42nd STREET

New York 36, N. Y.

ABP • ABC

MORE TIME FOR STEELMAKING... LESS TIME ON REPAIRS



You can keep steel-mill machinery on the job longer by using HAYNES hard-facing alloys to protect wearing parts. With hard-faced parts, you will have less down time and fewer repairs—more time for steelmaking. Illustrated here are some typical savings that have been made.

If you would like a copy of our hard-facing manual, which gives further information on the use of HAYNES hard-facing alloys, fill out the coupon below and mail it to us. For on-the-job help, get in touch with our nearest district office.

1. A yearly application of HAYNES STELLITE alloy No. 1 on this mud-gun screw for blast-furnace tap holes has eliminated monthly maintenance.

2. HAYNES STELLITE alloy No. 6 on the points of soaking-pit tongs has increased their life 19 times. Some hard-faced tongs have lasted as much as 50 times longer than unprotected ones.

3. The life of blooming mill shears has been increased 10 times by applying HASTELLOY alloy C on the cutting edge.

4. Entry guides for a bar-reduction mill used to wear out after handling 40 tons of steel. Guides hard-faced with HAYNES STELLITE alloy No. 6 last 4 to 5 times longer than unprotected ones.

5. Three years ago, some cone rollers in this bar-cooling bed were faced with HAYNES alloy No. 92. They are still in service.

"Haynes," "Haynes Stellite," and "Hastelloy" are trade-marks of Union Carbide and Carbon Corporation.

HAYNES Trade-Mark *alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC

USE THIS HANDY COUPON

Haynes Stellite Company, 726 S. Lindsay Street, Kokomo, Indiana

Please send me, without obligation, a copy of the booklet, "HAYNES Alloys—Hard-Facing Manual."

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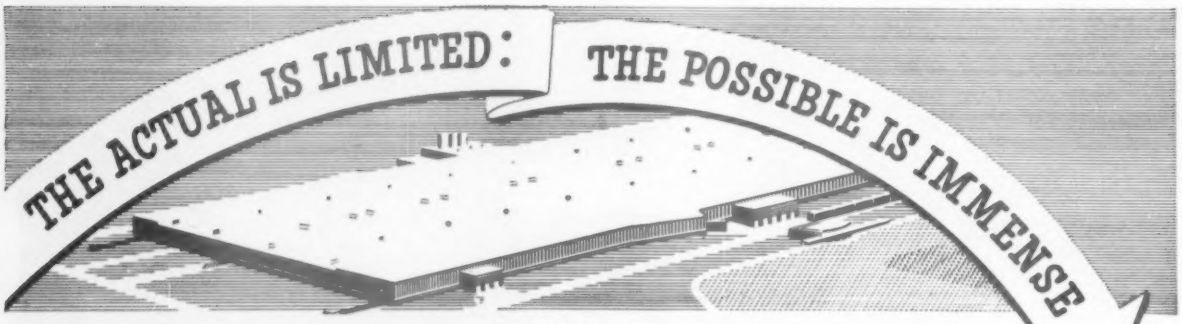
COMPANY_____

ADDRESS_____



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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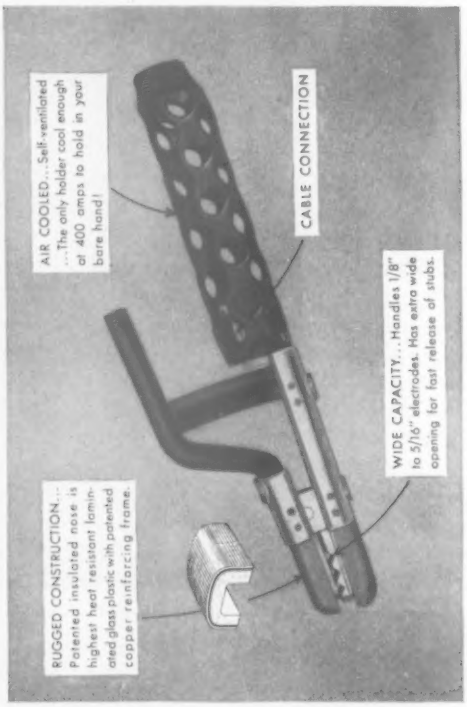
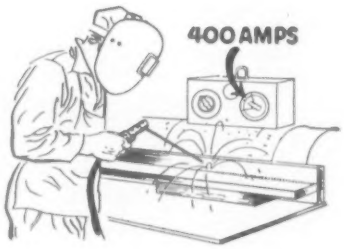
LINCOLN "COOLTONG"... the self-ventilated insulated holder

- **Long Life** Copper-reinforced-with-steel design outlasts holders of like capacity.
- **Perfectly Balanced** Feels lighter, more comfortable for easier welding in any position.
- **LOW PRICED** Has more range . . . yet sells for less than insulated holders of like capacity.


AIR COOLED... Self-ventilated ... The only holder cool enough at 400 amps to hold in your bare hand!
CABLE CONNECTION
WIDE CAPACITY... Handles 1/8" to 5/16" electrodes. Has extra wide opening for fast release of stubs.
RUGGED CONSTRUCTION... Patented insulated nose is highest heat resistant laminated glass plastic with patented copper reinforcing frame.

MAKE THIS TEST!



Set Welder at 400 amps and weld with the bare hand. "COOLTONG'S" unique self-ventilated design keeps the handle from getting too hot to hold with the bare hand. *Actually runs cooler than the cable!*

TOP VALUE

GET THE FACTS NOW—Write for Bulletin 845, Dept. 1702.

THE LINCOLN ELECTRIC COMPANY

Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

ESTABLISHED 1916

THE WELDING ENGINEER

MARCH, 1953

Looking Backward...

THERE ARE NEW FACES in high places, and their influence has already been felt. Like a breath of outdoors to a stifling, stuffy room, there will come fresh ideas and new concepts to help us to grow and prosper. It is greatly to be hoped, however, that the soundness of the American idea of free enterprise will continue to be recognized.

Among those who did not recognize the value of free enterprise in their times, we may cite such illustrious names as Karl Marx, ex-President Truman and Edward Bellamy.

Edward Bellamy may not be so familiar a name to you as the other two. He was the author of a novel of prophecy called *Looking Backward,* in which he set down his vision of the utopian world that would exist in the year 2000 A.D. Bellamy did not prove outstanding as a prophet in comparison with, say, Jules Verne. In the prophet business, he doesn't rate much better than Karl Marx, who was noted during his lifetime for being conspicuously wrong on practically everything.

The hero of *Looking Backward* is a nervous Bostonian who is troubled by insomnia. In order to get sleep, he even builds a special underground vault in which to pass his nights, but that isn't enough. Finally, in the year 1887, he calls in a hypnotist to put him to sleep. So well does the hypnotist do his job that the hero, his backyard vault conveniently buried by an earthquake, sleeps right through until the year 2000. He then wakes up to find a completely changed social pattern.

IN BELLAMY'S utopia, there was no place for individual initiative. He advanced the perfectly horrible thesis that opportunity was closed to small businessmen. His world of the future was run by giant corporations—colossal octopuses whose tenacles grasped practically all of industry and commerce. These in turn were owned—not by rich stockholders—but by a benevolent and bureaucratic government that told every individual where and when and how long to work—and how much he was going to get paid for it. Yet everybody was happy, said Bellamy. Everybody had plenty.

So far we seem to be following a depressingly familiar pattern, but the things that Bellamy *didn't* see are much more remarkable. For here is where he really fell down.

HE DIDN'T foresee arc welding, a process patented in the very year 1887 in which his hero began the big sleep. This oversight is typical; Bellamy didn't have even a glimmer of the technical advances to come.

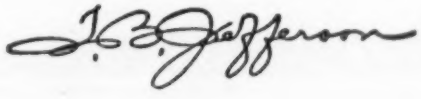
The things that Bellamy didn't see have certainly changed the world since 1887. The petroleum industry, for instance, was then a very young infant. Bellamy could have drawn a vivid forecast of thousands of miles of welded pipelines serving as transportation arteries for oil and gas. He doesn't mention petroleum.

Somehow he also overlooked the auto industry—steam trains and electric street railways were enough to get his dwellers in the year 2000 around. Aviation wasn't visualized either, nor was radio. Bellamy did have the idea that music would be sent into homes—but it was to come over telephone lines. Presumably his people still had arc lights and no fluorescent lamps. Not a very progressive world.

It is no mere coincidence that Bellamy fell down so badly as a prophet. The man whose imagination is limited to the collective state cannot be expected to visualize the fruits of individual enterprise But you can give Bellamy credit for one thing: he did see that no change for the better can be brought about by violence. This makes him vastly the superior of the-end-justifies-the-means school of thinkers of recent times. Nevertheless, his big idea was simply to share the wealth that existed in 1887. Wearing the blinders of the corporate state, he was not able to see that new wealth, vastly greater, would be created by technological progress.

Had the year 1887 been shackled by the corporate state, in the manner Bellamy prescribed, his dismal prophecy of the future might well have been a true one.

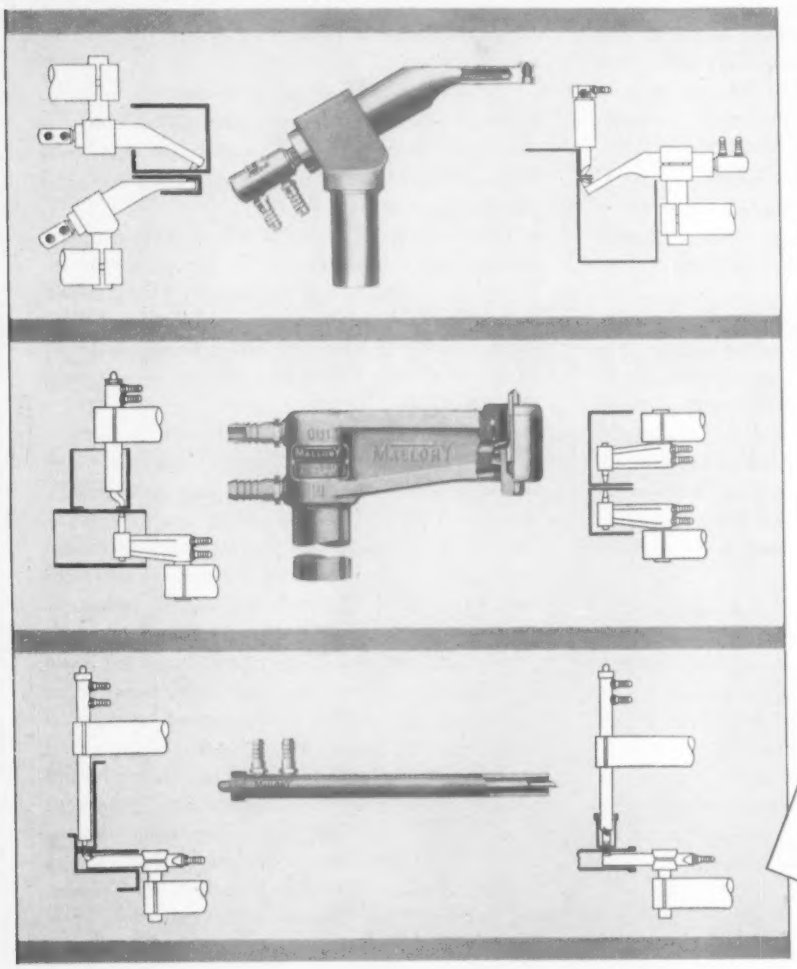
Fortunately, the sleeping hero didn't wake up in 1953. Opportunity is still ours.



Hard to Reach Spot Welds Don't Need Special Holders and Electrodes

Before you start figuring on special holders and electrodes to handle that "special" job . . . be sure and check with Mallory first. A wide variety of standard holders and electrodes, available from stock, can be combined to fit practically any special welding job.

Here are a few examples of what we mean:



In over 25 years of resistance welding experience, Mallory has developed a complete family of holders and electrodes. A quick look through our Catalog 550C will give you an idea of the almost limitless variations of holders and electrodes that are available to handle your special job economically. Call your Mallory distributor and ask him for a copy, or if you prefer, write us directly.

Expect more . . .
Get more
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You can always depend on outstanding performance and engineering service when you call Mallory for:

Holders
Electrodes
Rods and Bars
Castings
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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

1—MASSIVE size of an all-magnesium yard ramp is shown here. This model weighs under a ton but can carry eight tons

Welding Structural Magnesium

With a 50-50 Mixture of Helium and Argon

By C. RIDGELY KEMP

Vice-president in Charge of Production, Magnesium Company of America

BIGGEST fabricator of magnesium plate (¼ in. and over) and castings is the Magnesium Company of America (Magcoa) at its plant in East Chicago, Ind. Being a pioneer and a leader means asking for certain troubles, though, and Magcoa has had them in many aspects of its struggle to the top of its business. Welding problems, in particular, required considerable initiative and ingenuity before solution was possible. Even today, new problems must be solved as new products come from the designer.

Fortunately, many of the supervisory personnel have had a comprehensive background in the working of magnesium, both as a primary metal and in fabrication. A number of our key employees were previously employed by the country's largest basic producer of magnesium.

Any discussion of structural magnesium welding equipment must start out with an acknowledgment of the work at Northrop Aircraft, where the first practical inert-arc welding of the light metals was done on a pro-

Table I. How Mixed Shielding Gas Affects Tensile Strength

Thickness, in.	Current, Amp	Shielding Gas and Rate of Flow, cfm	Tensile Strgth., psi	Elong., % in 2 in.
0.250*	170	Argon, 0.20	15,550	2.0
0.250*	170	Argon, 0.20	15,550	2.0
0.250*	170	Argon, 0.10 Helium, 0.10	22,100	6.0
0.250*	170	Argon, 0.10 Helium, 0.10	22,100	6.0
0.375	300	Argon, 0.24	19,995	3.0
0.375	300	Argon, 0.24	17,300	3.0
0.375	300	Argon, 0.12 Helium, 0.12	32,375	4.0
0.375	300	Argon, 0.12 Helium, 0.12	33,400	7.0
0.500	350	Argon, 0.30	12,625	1.5
0.500	350	Argon, 0.30	15,800	2.0
0.500	350	Argon, 0.15 Helium, 0.15	17,700	3.1
0.500	350	Argon, 0.15 Helium, 0.15	17,200	3.0
0.625	400	Argon, 0.30	12,700	2.0
0.625	400	Argon, 0.30	12,620	2.5
0.625	400	Argon, 0.15 Helium, 0.15	17,300	3.0
0.625	400	Argon, 0.15 Helium, 0.15	16,650	3.0

**Flat plate 1-in. wide. Balance of samples were 1-in.-wide tread plates.*

3—PAINTED figures on the welder case save Magcoa thousands of dollars a year

4—LEO GRZYCH, weldor and instructor, is looking at the flowmeter that measures the 50-50 argon-helium mixture of shielding gas

duction basis in 1941. Rapid strides were made after that, not only in factories here but at Army and Navy air force repair depots.

Venture in New Field

Until 1946, however, very little work had been done on magnesium of a gage that would be heavy enough for the flood of postwar designs. Magnesium wheelbarrows, garden tools, forgings, cabinets for portable communication equipment and other products were pictured in four colors in popular magazines, and harried production men were asked to make them. Some companies produced marketable products and caught on. Others didn't. Either they gave up, or they were absorbed by more successful competitors.

Magcoa officials in 1946 did some hard thinking about their future product designs. What type of factory equipment would be most popular if it utilized magnesium's outstanding features: its feather lightness (only one-fourth as heavy as steel) and its high strength-weight ratio.

Materials-handling equipment of magnesium seemed to promise a lot, particularly for pieces of equipment that have to be moved by hand or otherwise shifted into position using arm and back muscles. Dockboards provide an excellent example. Used to facilitate loading and unloading, dockboards of steel plates may weigh as much as 750 lb. Wooden models weigh less but cannot carry the loads imposed by new power loading equipment. They're subject to considerable breakage, and a high replacement rate is almost unavoidable. A magnesium dockboard weighs about 75% less than a steel one of comparable capacity. These lightweight dockboards have been constructed for loads as high as 30,000 lb on one axle of the power-handling vehicle. Life of the dockboards is computed in years of rugged service.

Newest product from the Magcoa plant is the portable yard ramp shown being welded in Fig. 1. It is capable of supporting a heavy fork-lift tractor plus a heavy load of freight (Fig. 2). Capacities range between 6,000 lb and 16,000 lb. Ramp lengths range between 24 and 30 ft, with each larger size gaining in width and in depth to withstand the greater stresses.

A single man can move the ramp on its two wheels to the side of any freight car. Through the use of the built-in hydraulic jack, he can elevate the ramp end to car-door height in a few seconds.

2—PORTABLE yard ramp being used outside a factory. Extra docking space for loading and unloading freight cars is in effect provided by this ramp

Seven-Year Development

When a design has been chosen and approved by Magcoa management, it becomes the job of the fabrication division to produce the designed product as rapidly, efficiently and economically as possible. Inert-arc welding is the major fabricating tool for this task, and we hold it largely responsible for our success.

We have used this process almost from its infancy. When we first began to use inert-arc welding six or seven years ago, no suitable electrode holder

for production welding of ¼-in. magnesium was commercially available. We were forced to make electrode holders to our own design.

In early days, the shielding gas was helium, and we used 150-amp d-c machines with reverse polarity. We didn't have much trouble with the arc—it was steady and fairly easy to handle. Lack of penetration, however, was a constant problem. The arc intensity was too low for any great penetration at the point of welding. To assure the complete penetration we insisted upon, we found it necessary to bevel all edges and make multiple-pass welds.

About five years ago we decided to investigate the use of a-c welding equipment fitted with a high-frequency attachment for superimposing a starting current on the welding current. Switching to a-c welders permitted us to use higher amperages with the same diameter of tungsten. At that time we also changed from helium to argon as the shielding gas to reduce welding costs. Though the latter gas (argon) costs more, we found it cheaper, all things considered. Here's why:

Argon seems to provide a greater concentration of heat at the welding arc, and penetration difficulties were practically eliminated. In most cases, the work that previously required beveling of joints and multiple passes could now be done without such edge preparation and with a single welding pass.

For this work we use Dow FS alloy plate and extrusions. The plate is low in calcium to eliminate the danger of most weld cracking during cooling. Our filler rods are J alloy and range from 1/16 to ¼ in. in diameter. C alloy rods can also be used.

On the negative side, we found that arc stability with argon isn't as good as with helium. The only thing we can do about this is to train our weldors better and to stress the necessity for holding a short arc.

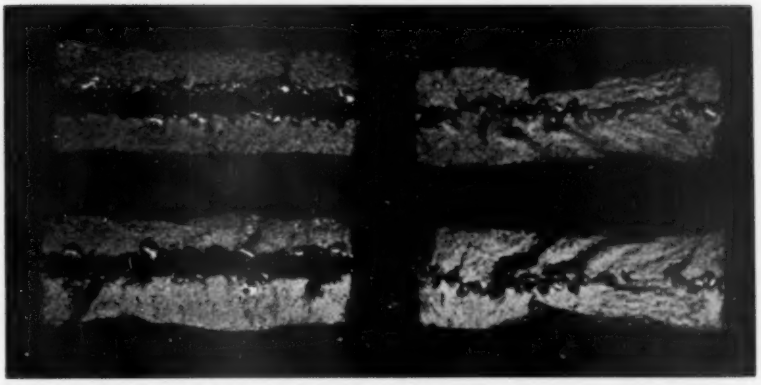
From the cost side, argon gas is more expensive, roughly 67% more than helium. Even though it is used at low flow rates, its total cost to a plant can mount very rapidly.

Saved $1,000 per Month

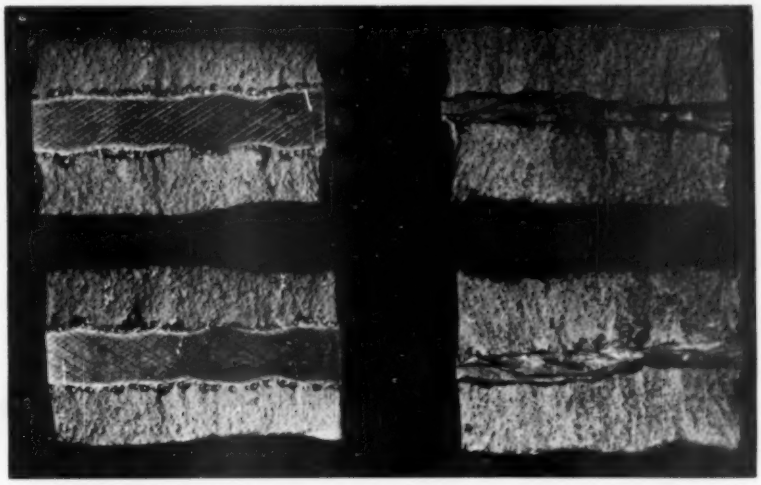
To save on this costly shielding gas, we originated the simple control shown in Fig. 3 to monitor argon flow. We have estimated the savings brought about by this very simple procedure to amount to as much as $1,000 per month.

It works this way: Painted figures were put on the welder casing opposite various amperage indications to show the proper amount of gas that should be flowing through the electrode holder. We use such flows as 0.20 cfm for 100-200 amp, 0.25 cfm for 200-400 amp, etc., as experimentally determined. Welding foremen and supervisors make several spot checks each day to see whether the flowmeter (shown at left of the weldor in Fig. 4) reads correctly for the current the operator is using. Even small discrepancies bring a warning to the weldor; repeated violations of this rule bring dismissal.

Perfection is always around the corner at Magcoa and is our constant aim, as it is in every progressive plant. Not long after we had the argon welding process working, with all of the bugs out of it, a new scheme for even better welding began to attract our interest.



5—FLAT plate, 0.250 in. thick. Comparison of these samples shows a shallow bead with argon (left), deeper penetration with mixture (right)



6—TREAD plate, 0.500 in. thick. Argon-helium mixture shows to good advantage in right samples. Note blowholes in the argon samples at left

Hear of Mixture Idea

At a technical session of the Magnesium Association in 1952 at Detroit, a question was raised about the possibility of mixing argon and helium for a shielding gas. None of the members present had had any experience along this line, and the subject was dropped. However, we brought the idea home, and a development program was set up to investigate the possibilities.

Possible advantages to be obtained from mixing the gases appeared to be two. These were:

Item one: the matter of lower gas costs. A mixture of 50% argon (by volume) and 50% helium costs $0.10

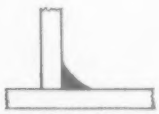
(Continued on page 46)

TABLE I

COMPARATIVE DATA ON MANUAL SHIELDED-ARC FILLET JOINTS

APPROX. FILLET SIZE, IN.	WELDING POSITION	TYPE OF ELECTRODE, DIAM	ELECTRODE MELT-OFF RATE, (IPM)	NO OF PASSES	WELDING CURRENT (A-C)	FT OF JOINT WELDED PER HOUR (100% OPERATING FACTOR)	COST OF WELDING MATERIAL PER FOOT OF JOINT	COST OF POWER PLUS MATERIAL PER FOOT OF JOINT
3/16	FLAT	5/32" E-6020	12.0	1	170 Amp	50.00	$0.0151	$0.01761
	HORIZONTAL	5/32" E-6012	10.0	1	150 Amp	40.00	.0140	.01550
¼	FLAT	3/16" E-6020	11.0	1	220 Amp	38.20	.0260	.02970
	HORIZONTAL	3/16" E-6012	9.1	1	190 Amp	31.65	.0234	.02628
⅜	FLAT	⅛" E-6020	9.4	1	300 Amp	24.00	.0617	.07009
	HORIZONTAL	⅛" E-6012	8.0	1	265 Amp	20.00	.0542	.06003
½	FLAT	⅛" E-6020	9.4	2	300 Amp	13.35	.1100	.12501
	HORIZONTAL	⅛" E-6012	8.0	2	270 Amp	11.00	.0985	.10932
⅝	FLAT	⅛" E-6020	9.5	2	305 Amp	9.25	.1620	.18580
	HORIZONTAL	⅛" E-6012	8.1	4	270 Amp	7.50	.14630	.16217

ASSUMPTIONS: 1. ELECTRODE COST @ $0.13 PER LB OF E-6012 AND E-6020
2. STUB END LOSS — 2 INCHES
3. POWER COST @ $0.02 PER KWH



HORIZONTAL POSITION

FLAT POSITION

Will Inert-Gas Metal-Arc Save Money on Mild Steel?

What the Tests Showed

1. Macroscopic examinations indicate that sound fillet welds can be obtained by this process.

2. The backhand technique proved to be the most successful method of obtaining sound fillet welds without undercut.

3. It is preferable to weld fillet joints in the flat position.

4. Clean welds with no spatter are obtained.

5. Faster welding speeds can be obtained. The possible increases are: 100% for small, single-pass fillet welds and 50% for large, multiple-pass fillet welds.

6. Present costs of materials (wire and shielding gas) for the inert-gas process are approximately three times material costs for the shielded-arc process.

7. Total costs of fillet joints welded by the inert-gas process are lower than total costs of joints welded by the manual shielded-arc process. A ¼-in. single-pass fillet weld costs approximately 30% less; large, multiple-pass fillet welds about 10% less.

8. The use of welding wire of larger diameter for multiple-pass welds should be investigated.

By G. C. CHRISTOPHER and R. C. BECKER

AN investigation was conducted at the manufacturing research laboratories of International Harvester Co., Chicago, to determine the applicability of the inert-gas-shielded metal-arc process to welding of low-carbon steel. This investigation has indicated that there are certain limiting features to the process, both economical and operational.

In a group of tests, the inert-gas

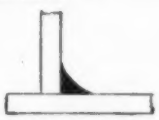
TABLE I gives the welding conditions for tests conducted by manual shielded-arc process. Table II summarizes data for inert-gas welding of the same sizes of fillets. Table III is a hypothetical cost comparison of the two processes, based on Tables I and II.

TABLE II

COMPARATIVE DATA ON MANUAL INERT-GAS METAL-ARC FILLET JOINTS

APPROX. FILLET SIZE, IN.	WELDING CONDITIONS						PRODUCTION DATA		
	WELDING POSITION	TYPE OF ELECTRODE, DIAM	ELECTRODE MELT-OFF RATE, (IPM)	INERT-GAS CONSUMPTION, CFH	NO OF PASSES	WELDING CURRENT (D-C, r.p.)	FT OF JOINT WELDED PER HOUR (100% OPERATING FACTOR)	COST OF WELDING MATERIAL PER FOOT OF JOINT	COST OF POWER PLUS MATERIAL PER FOOT OF JOINT
3/16	FLAT	1/16" A-650	150	40	1	330 Amp	110.0	$0.0500	$0.05155
	HORIZONTAL	1/16" A-650	150	40	1	320 Amp	120.0	.0481	.04975
1/4	FLAT	1/16" A-650	150	40	1	320 Amp	70.0	.0845	.08727
	HORIZONTAL	1/16" A-650	150	40	1	325 Amp	70.5	.0819	.08453
3/8	FLAT	1/16" A-650	155	40	1	340 Amp	38.8	.1506	.15600
	HORIZONTAL	1/16" A-650	155	40	1	335 Amp	32.3	.1808	.18755
1/2	FLAT	1/16" A-650	155	40	1	335 Amp	19.3	.3018	.31460
	HORIZONTAL	1/16" A-650	155	40	3	340 Amp	17.0	.3433	.35512
5/8	FLAT	1/16" A-650	155	40	2	340 Amp	14.1	.4186	.43500
	HORIZONTAL	1/16" A-650	155	40	3	335 Amp	12.3	.4745	.49222

ASSUMPTIONS: 1. WELDING WIRE COST @ $0.217 + $0.02 ROYALTY PER LB
2. ARGON GAS + OXYGEN COST @ $0.10 PER CUBIC FOOT
3. POWER COST @ $0.02 PER KWH

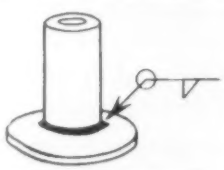


HORIZONTAL POSITION

FLAT POSITION

TABLE III

COMPARATIVE COST ON A HYPOTHETICAL WELDING APPLICATION
(COST PER 100 ASSEMBLIES)

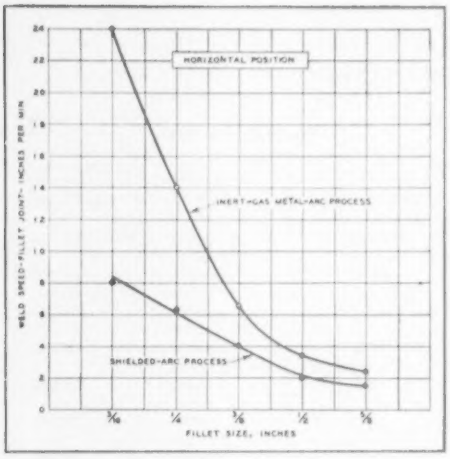


ASSUMPTIONS	INERT-GAS METAL-ARC PROCESS	MANUAL SHIELDED-ARC PROCESS
OPERATING EFFICIENCY	85%	50%**
DEPOSITION EFFICIENCY	95%	60%
WELD LENGTH	3 FT	3 FT
WELD POSITION	HORIZONTAL	HORIZONTAL
ADJ. FOR DOWNTIME	15%	15%
LABOR COST	$2.10 PER HR	$2.10 PER HR

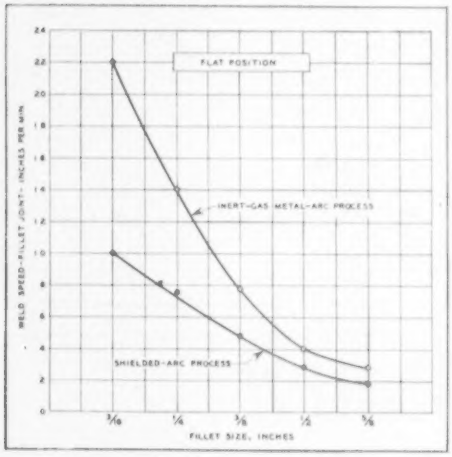
FILLET SIZE, IN.	MATERIAL (*)		TOTAL LABOR COST		TOTAL COST PER 100 ASSEMBLIES	
	SHIELDED-ARC	INERT-GAS METAL-ARC PROCESS	SHIELDED-ARC	INERT-GAS METAL-ARC PROCESS	SHIELDED-ARC	INERT-GAS METAL-ARC PROCESS
3/16	$4.65	$14.93	$37.00	$7.28	$41.65	$22.21
1/4	7.88	25.36	46.70	12.30	53.58	37.66
3/8	18.01	56.27	74.20	27.01	92.21	83.28
1/2	32.80	106.54	135.00	51.40	167.80	157.94
5/8	48.65	147.67	198.00	71.00	246.65	218.67

*INCLUDES COST OF ELECTRODES, ELECTRICITY AND IN THE CASE OF THE INERT-ARC PROCESS THE INERT-GAS CONSUMPTION IS ALSO INCLUDED.

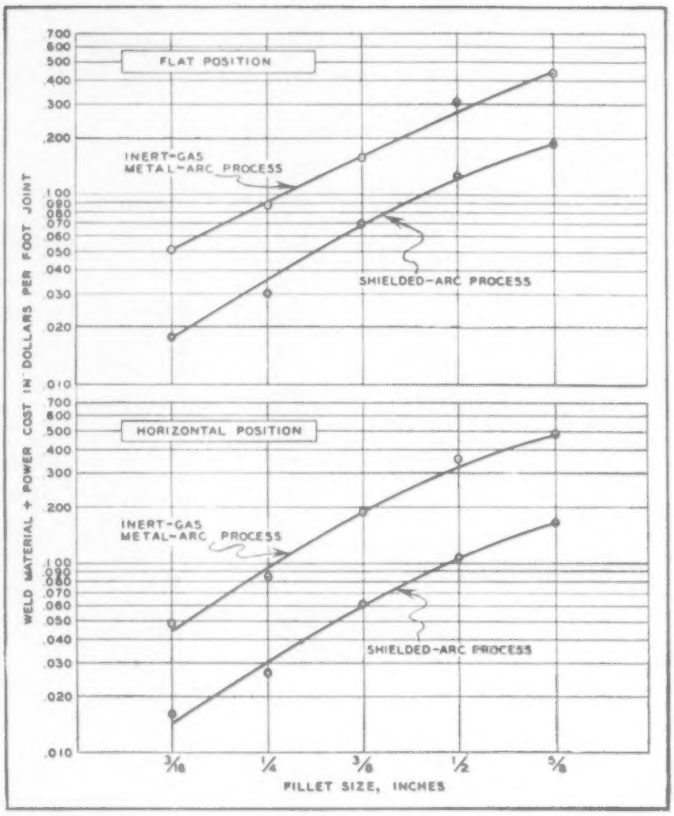
**INCLUDES TIME REQUIRED FOR CLEANING SLAG AND CHANGING ELECTRODES.



1—SPEED and fillet size, horiz. position



2—SPEED and fillet size, flat position



3—COST-per-foot and fillet size, flat and horizontal positions

CHARTS 1 and 2 show welding speed as a function of fillet size for horizontal (Chart 1) and flat (Chart 2) positions. The curves for the inert-gas metal-arc process and for the shielded-arc process indicate that a greater differential in welding speeds exists for the smaller fillet sizes. Similar comparisons of weld-material and power costs for various fillet sizes are made in Chart 3

metal-arc process was compared with the manual shielded-arc process. These tests consisted of fillet-welded joints with fillet sizes of 3/16, 1/4, 3/8, 1/2 and 5/8 in. Low-carbon steel was used throughout. The electrode wire was 1/16-in. copper-coated wire of high-manganese steel. Its chemical analysis revealed: carbon 0.09%; manganese 1.31%; silicon 0.25%; phosphorus 0.010%; sulphur 0.025%; aluminum, trace.

Test Conditions

Weld samples 3 by 12 in. were cut from each of five plate thicknesses: 3/16, 1/4, 3/8, 1/2 and 5/8 in. Two of these plates were assembled to form a T-joint. No attempt was made to remove the mill scale and rust from the plates prior to welding. Two samples of each size of fillet joint were welded in both the flat and horizontal position. No other joint preparation was required except to tack weld the ends of the fillet joint. Fit-up of the fillet joints was not held to a close tolerance; the variance measured from 0 to 1/16 in.

A cross-section of each fillet weld in the five plate thicknesses was prepared for microscopic examination at various magnifications.

The welding equipment consisted of a 600-amp d-c motor-generator set and a 400-amp magnetic contactor for current control. A standard 400-amp a-c transformer was used for the manual shielded-arc samples. A recording voltmeter and recording ammeter were connected into the welding circuit for recording of the arc voltage and arc current. Since all welding was done manually, it was necessary to calculate the welding speed from the arc time, as obtained from the recording ammeter, and the length of weld, as measured on the test plate.

Welding Procedure

A commercial flowmeter, calibrated in cubic feet of gas per hour, regulated the inert gas flowing to the welding arc. An oxygen-argon proportioner controlled the mixture of the shielding gas. The shielding gas consisted of argon plus 2-3% oxygen in the horizontal position and argon plus 1% oxygen in the flat position. The calibrated gas-mixing device furnished a uniform mixture.

Throughout this investigation, electrode melt-off rate was held within the range of 150 to 155 ipm. The current range found to give the optimum performance with the 1/16-in. electrode wire was 320-340 amp, d-c, reverse polarity.

The two basic techniques of manual welding are termed forehand and

backhand. Some of the inherent disadvantages of the forehand technique are:

1. The arc forces resulting from using very high-current densities create a localized digging action that is very inducive to undercutting.

2. The relative lack of weld-metal wetting action (inherent to the inert-gas process) restricts the flow of weld metal up the sides of the fillet legs.

3. The operator's view of the weld metal puddle is impaired because of the size and position of the gas nozzle. Hence the operator is unable to manipulate the puddle so as to minimize the effects of items Nos. 1 and 2.

Forehand Advantages

A distinct advantage of using the forehand technique for horizontal fillet welding is that higher weld speeds are possible. The operator can more readily guide his direction of travel because he can see a greater portion of the unwelded joint directly in front of the arc. Wherever higher welding speeds are required and the quality of the weld appearance becomes secondary, the use of the forehand technique would be very suitable.

Investigation of the forehand technique for flat fillet joints indicated that undercutting characteristics were less predominant as compared to horizontal welds. Since the undercutting condition was not completely eliminated, however, the backhand technique was used for the flat fillet welds.

Backhand Advantages

The backhand technique has superior welding characteristics for both flat and horizontal fillet joints:

1. A good view of the weld puddle is possible.

2. Manipulation of the arc and the weld puddle makes it possible to obtain a smooth, concave weld bead without the presence of undercutting.

3. Larger weld beads can be obtained.

4. It is easier to weld joints having poor fit-up.

In horizontal inert-gas welds, 3/16, 1/4 and 3/8 in. fillets were made in one pass; the 1/2 and 5/8 in. fillets in three passes. In the flat position, the 3/16, 1/4, 3/8 and 1/2 in. fillets were made in one pass; the 5/8-in. fillet in two passes. In making the multipass joints, no time was lost in electrode changing or for the removal of slag.

With manual shielded-arc welding (coated electrodes), the 3/16, 1/4 and 3/8 in. fillets were welded in one pass in the flat position, while the 1/2 and 5/8 in. fillets were welded with two passes. E-6020 electrodes were used. In the horizontal position, the 3/16, 1/4 and 3/8 in. fillets were welded in one pass, while the 1/2 and 5/8 in. fillets were welded with two and four passes respectively. E-6012 electrodes were used for all horizontal welds.

What Were Results?

The welding data accumulated from these various fillet weld tests are recorded in Tables I and II. Table I gives the welding conditions of duplicate weld tests conducted with the manual shielded-arc process on the various sizes of fillet joints, and Table II a summary of the welding conditions for inert-gas welding of the same sizes of fillet joints. It should be noted from these tables that in the case of the smaller fillet sizes (3/16 and 1/4 in.) the welding speed is two to three times as great for the inert-gas process as for the shielded-arc process. In the case of the larger fillet sizes (3/8 to 5/8 in.), this differential of welding speeds is reduced, being approximately only 1½ times as great for the inert-gas process. The welding material cost for the inert-gas process (wire plus shielding gas) is approximately three times the cost of material for the shielded-arc process.

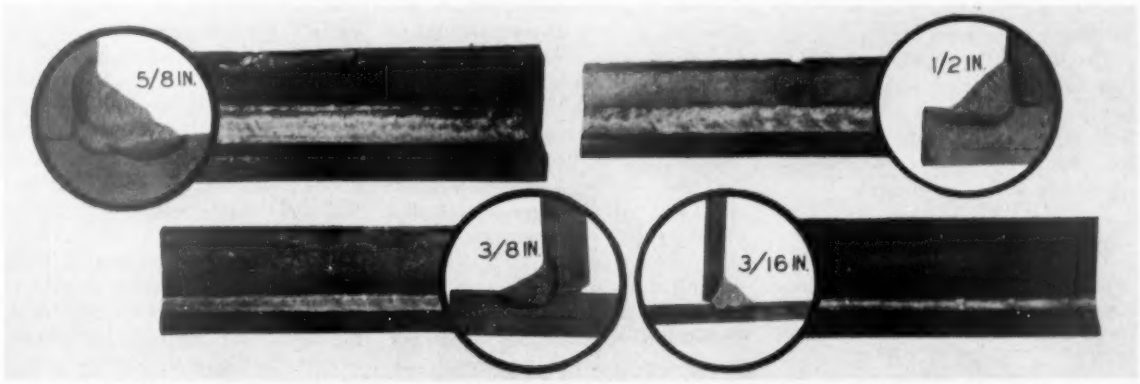
A greater advantage in welding speed was obtained with the inert-gas process on the smaller, single-pass fillet welds. Why? One explanation is that a constant welding-wire size (1/16 in.) was used for the inert-gas welds while for the shielded-arc samples the electrode size varied from 5/32 to ¼ in. The data obtained for the larger fillet welds would probably have been changed materially if 5/64 or 3/32 in. welding wire had been used for the inert-gas samples. The use of larger welding wires for the larger fillet welds is now being investigated.

The curves of Charts 1 and 2 show welding speed as a function of fillet size for both the inert-gas and shielded-arc processes in the horizontal and flat positions. These curves indicate that a greater differential in welding speed exists for the smaller fillet sizes. This differential is considerably reduced as the fillet size increases.

In Chart 3, the curves show material and power costs as a function of fillet size for both the inert-gas and shielded-arc processes in the horizontal and flat positions. These costs increase directly with increasing fillet sizes. In all cases, however, the material costs of the inert-gas process are higher than those for the shielded-arc process.

Cost Comparison

Table III shows a hypothetical



4—FILLET joints welded by inert-gas metal-arc. The distortion shown here is the result of shrinkage stresses

cost comparison between the inert-gas and shielded-arc processes for several fillet sizes ranging from 3/16 to 5/8 in. The assumptions that had to be made to establish such a comparison are listed in the upper portion of the table. These assumptions, when used with the data presented in Tables I and II, resulted in the comparative cost given for 100 assemblies.

Table III shows that for the smaller fillet joints, *i.e.*, the 3/16-in. fillet, the total cost of the manual shielded-arc process is twice that of the inert-gas process. For the larger size of fillet joints, *i.e.*, the ½-in. fillet, the cost difference is marginal between the two processes. It should be pointed out, however, that these comparative values are meant to be used only as a guide toward the analysis of possible applications of the inert-gas process.

According to Table III, material costs of the inert-gas process are approximately three times those of the shielded-arc process. This condition considerably limits the potential economies of the inert-gas process. To offset the high material costs, however, potential savings are provided by (1) increased welding speeds, (2) elimination of slag-removal operations and (3) low spatter losses. Furthermore, the indications are that the high material costs of the inert-gas process will be reduced as more industrial applications are found.

Some typical fillet joints (3/16, 3/8, 5/8 and 1/2 in.) welded with the inert-gas process are shown in Fig. 4. The distortion that is revealed in these macrographs is the result of shrinkage stresses caused by continuous welding on only one side of the T-joint. The tack welds, since they were placed only on the ends of each weld sample, did not sufficiently restrain the joint to counteract the shrinkage stresses set up by welding.

The ½-in. fillet depicts a condition that has been noted whenever poor fit-ups are encountered. The unfused weld metal adds no strength to the weld, but its presence is not otherwise considered to be detrimental.

* * *

The authors wish to express their appreciation to Messrs. Ward Cunningham and Dell Moerke, of Air Reduction Sales Co., and to Nick Besich, of International Harvester Co.

STRUCTURAL MAGNESIUM

(Continued from page 41)

per cu ft for argon and $0.06 per cu ft for helium. Figure it out yourself: the cost of the mixture is $0.08 per cu ft, a 20% saving.

Item two was the even more important matter of improved operating characteristics. We could get a higher arc voltage (affording greater penetration) for the same current and increased arc stability compared to straight argon.

We translated the idea into equipment with the coöperation of applications engineers from our various welding suppliers. The set-up in Fig. 4 was finally evolved. There are three flowmeters in this picture. Below and to the left of the flowmeter between the two cylinders is the T-coupling that connects the two gas sources. This leads in turn to the inert-gas electrode holder.

Gratified with Results

Tests run with the 50-50 mixture of helium and argon indicated that the new shielding gas should be put into the production line as soon as possible. Table I shows a series of tests made with welded magnesium plates of thicknesses ranging from 0.250 in. for flat plate to 0.625 in. for tread plate. Test samples were cut from weldments measuring 12 by 24 in., assembled from 6-in. wide plates and welded down the 24-in. joint.

No edge preparation was used on these samples; the two sawed edges were simply butted together without any gap. Each sample was welded with one pass on each side of the joint without any back-up. There was no finish grinding done on the weld bead.

Welding with argon gas as the shielding blanket, tensile strengths of 15,550 psi were obtained for two 1-in. wide strips sawed from a 0.250-in. sample plate. When 50% argon-50% helium was used as a shielding medium, welds in the same plate thickness showed a tensile strength of 22,100 psi. Welding current and welding speed were the same in both cases. An increase of 42% in tensile strength was obtained because of the greater penetration. Of course, these are not typical production welds, but were made at lower amperages calculated to show the differing penetrations possible with the two types of gas shielding.

For 0.625-in. tread plates (plates with a non-skid tread) welded with argon only, tensile strengths of 12,700 psi and 12,620 psi were obtained. These figures were lower than those for 0.250-in. flat plates because a smaller percentage of the thickness was welded. When a mixture of argon and helium was used, strengths were boosted to 17,300 and 16,650 psi, an average increase of 33%.

Compare Samples

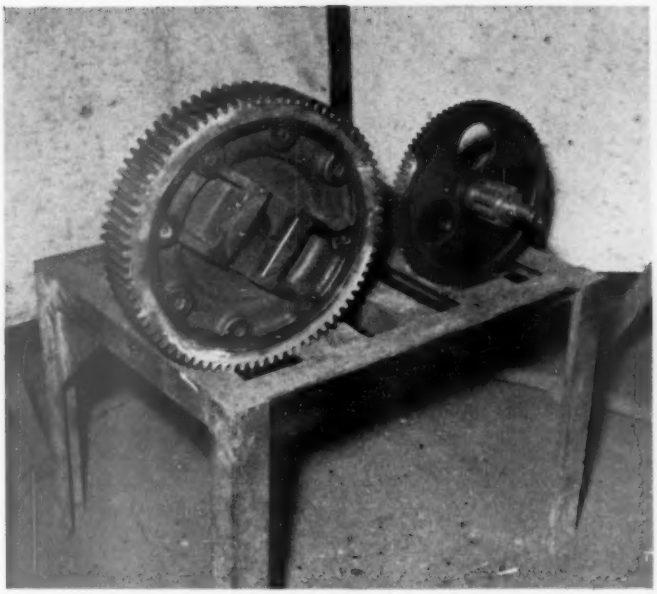
Figures 5 and 6 show several of the welded tensile specimens from Table I after they failed in tension. All samples failed across the weld, depicted rather graphically in the photos. Figure 5 shows the 0.250-in. plate. On the left are the argon-shielded samples. Note that about 1/16-in. of the center part of the joint was never fused. At the right are samples welded with both gases. The increased heat available at the arc has resulted in almost complete penetration.

On the samples at left of Fig. 6, argon shielding produced a penetration of about 0.160 in. on each side of the joint in ½-in. plate. The current was 350 amp. With the same welding current, the gas mixture produced a considerably greater penetration (right samples), perhaps as much as 0.20 in. Furthermore, the blowholes that stand out conspicuously in the sample strips at left are missing from the joint at right

The gas-mixing attachment was fitted to two welders following the tests. Right now these machines are welding pressure vessels and extremely thick sections of structural assemblies such as the yard ramp. The new shielding mixture has reduced the number of leaks in the pressure vessels from ten or more per unit to one or two. No change was necessary in procedure or operator training.

Even though we are well satisfied with the results we have achieved, the weldors at Magcoa are not resting on their laurels. We are now thinking about a new heavy-duty holder that will weld faster and cooler in the 600-800 amp range.

When other improvements in welding magnesium are made, we plan to be up in front. Our experience with the metal and the inert-gas process over the last several years gives us a good start.



1–RETARDER gear with teeth built up with bronze weld metal

2–CRACKED bell seemed beyond any repair

It's Bronze for Build-up

BY J. A. LUSTECK

District Engineer,
Eutectic Welding Alloys Corp.

WHEN it comes to the repair of damaged castings and heavy machinery, the use of brass or bronze welding rods and electrodes provides the weldor with versatile tools. Naturally, these materials are ideally suited to the joining of bronzes and brasses. They may also be used in the repair of cast iron and other ferrous materials in "braze welds" where the melting point of the filler metal is below that of the base metal.

Here are two examples:

1—Retarder Gears Repaired

The retarder gears pictured in Fig. 1 had been worn to such an extent that they seemed suitable only for the scrap heap. These costly gears wear rapidly because they are subjected to terrific strains from sudden pulls, as well as backlash. Their salvage by welding means savings of thousands of dollars to the railroad industry. It can be accomplished with bronze.

The problem is one of building up the worn segments of the gears with a high-strength, wear-resistant material. For this application, a high-tensile bronze was selected. It produces a hard, tough overlay, which is highly ductile and fully machinable. When this bronze alloy is applied with the oxyacetylene torch, the heat is sufficiently low to minimize all danger of warpage and embrittlement.

The reclamation process is simple. First (as in all welding operations), the gear was thoroughly cleaned. It was then preheated to a dull red. The build-up was started with a flux-coated, high-tensile bronze rod, which was rubbed on the surface until the flux flowed freely, using a neutral flame. The flame cone was held about ¼ in. from the base metal. This initial rubbing prepared the base metal for the build-up and also indicated the approximate bonding temperature of the alloy. Thin layers of weld metal were then deposited until the desired build-up had been obtained.

When the deposition was completed, the gears were machined and returned to service. A close examination of Fig. 1 will reveal that only one-fifth of the original cast-iron gear teeth remains in the repaired area. The new teeth, therefore, are four-fifths built up of high-tensile bronze. Even so, the repair proved so successful that one railroad has adopted it as a standard procedure.

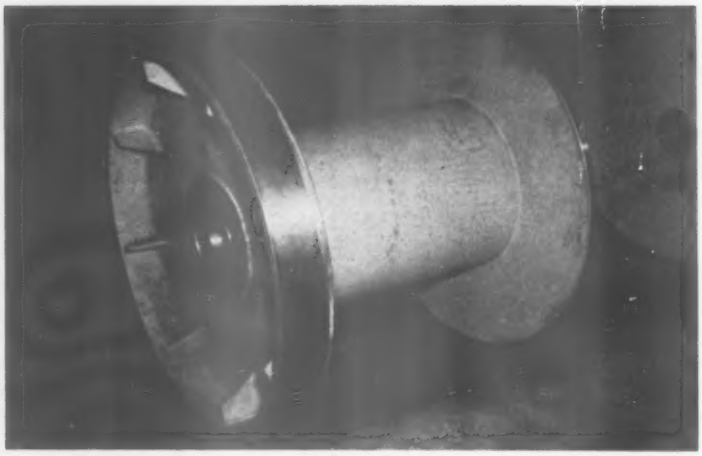
2—Bell Tone Restored

A similar flux-coated welding rod was used in the repair of a 286-year-old church bell.

Over a century before the signing of the Declaration of Independence—in the year 1666—a bronze bell was cast in Switzerland. This bell weighed 500 lb, stood 2½ ft high and was noted for its beautiful tone. After nearly 300 years of pealing, it cracked in three places and was seemingly beyond repair. However, a skilled weldor undertook to do the job.

The weldor realized that the problem of repairing the bell was great since even a slight distortion of shape might so change the tone quality as to render the bell useless. Hence all distortion was to be avoided, which meant low heat. Fortunately, he had available a non-fuming flux-coated bronze rod that bonds at 1,390 F. The bell was preheated to 450 F before the weldor began the repair. He used the oxyacetylene torch and deposited 8½ lb of weld metal to fill up the cracks. Because of the comparatively low heat input into the bell, there was no distortion and a dense, homogeneous deposit was produced. The tone of the repaired bell proved satisfactory, and the bell is good for another 286 years of service.

1—HEAVY brake drum is being welded to drum flange by submerged-arc process



2—CABLE drum almost completed. This big spool measures 4 ft in diameter and is made of non-magnetic (austenitic) stainless steel

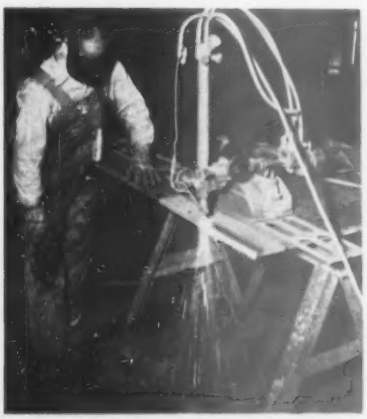
Heavy Weldments Call for

Powder cutting of stainless parts . . .

BY CLYDE B. CLASON

5—HAND cutting by the powder process is done on stainless parts

6—RELATIVELY smooth surface that was obtained by the hand cut



7—POWDER cutting is also done by carriage-mounted cutting torch

8—MACHINE powder cut shows a clean edge after removal of slag

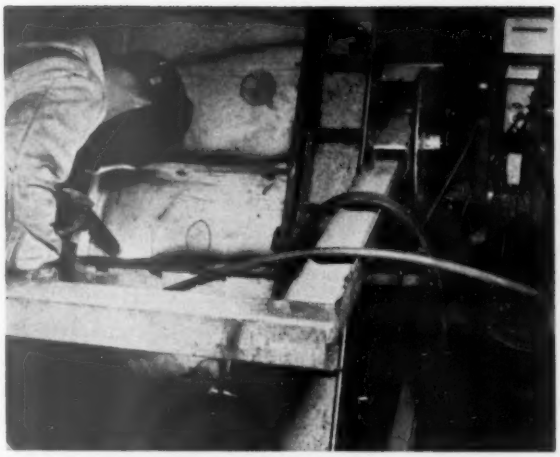
LYING just east of the Rocky Mountains, the city of Denver, Colo., is about as far from either ocean as it is possible to get. Yet the Queen City of the Plains is making parts for Uncle Sam's naval requirements. Not small parts either, but large-size weldments that must be shipped thousands of miles by rail before they can be installed.

Once they said that Denver had no heavy industry. Today the statement is far from true. Denver has many metal-fabricating enterprises of fairly good size, one of which, the Silver Engineering Works, is now busy producing heavy equipment for the U. S. Navy. All this marine equipment is of stainless steel.

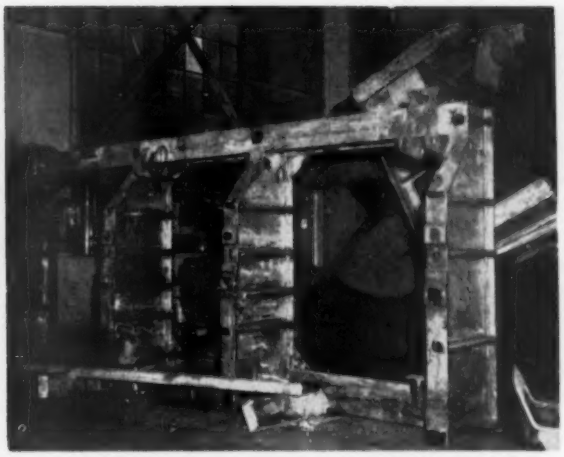
Stainless steel is necessary because the particular vessels must be entirely non-magnetic. Austenitic stainless steel is, of course, non-magnetic in its crystalline structure. Unless extreme care is exercised in planning and carrying out procedures, however, the heat of welding can cause a magnetic structure to be created in the weld zone.

Cable Drums

Submerged-arc welding is used both to assemble the components of cable winch drums and also for the purpose of building up special surfaces. These big drums are fabricated entirely from type 321 stainless, an 18-8 chrome-nickel, titanium-stabil-



3—UNDERFRAME assembly is speeded up by inert-gas metal-arc welding. Here a fillet weld is being made



4—NEARLY completed winch base. Giant positioner at rear kept the heavy weldment in the flat position

Careful Welding and Planning

ized alloy. The plates for the brake drums, end flanges and cable drums are 15/16 in. thick.

Figure 1 shows the submerged-arc welding of a brake drum to the cable drum flange. The circumferential weld runs about 13 ft in length. Two horizontal fillet welds are made—one on each side of the brake drum. Only one pass is necessary for each fillet.

No preparation is needed for welding except to position the parts on a special turning jig and tack weld the assembly together. Finish welding is done at a speed of 8 ipm with a current of 250 amp, a-c, at 32 volts. The electrode is of type 347 stainless (columbium-stabilized), 5/32 in. in diameter. A vacuum pick-up (manual) removes the unfused flux.

Figure 2 shows an almost completed cable drum.

Cable Machine Bases

Just as submerged-arc welding is used on the cable drums, the inert-gas metal-arc process is employed on all underframe assembly work. A hand gun feeds the electrode wire to the work automatically. Most of the welds are plain fillets in plate about $\frac{5}{8}$ in. thick. Again, the welds must maintain the non-magnetic quality of the stainless. The material is type 321, titanium-stabilized stainless.

Preparation for assembly requires only fit-up in jigs and tack welding. Special positioners and clamps are used for many types of subassemblies. Welding is done with d-c equipment, mostly at a setting of 350 amp. The 1/16-in. stainless electrode wire is fed at a speed varying from 3 to 6 ipm. The argon flow is 12 liters per minute.

In Fig. 3, a fillet weld is being made between a stiffener and a vertical plate, while Fig. 4 shows a nearly completed winch base. Note the giant positioner at the rear of this picture. Big as this base is, it is made entirely of non-magnetic stainless steel. Our front cover for this month pictures a smaller unit in the process of being welded on a positioner.

Powder Cutting

The parts for the unit are cut to shape and size by means of the powder-cutting process. The method is to inject an iron-rich powder into the cutting zone by compressed air that flows through the powder dispenser. The powder is heated to ignition temperature by the torch preheating flames and burns in the cutting-oxygen stream to create a high-temperature reaction.

Silver Engineering Works has adapted powder cutting to both the hand torch and flame-cutting machines. Figure 5 shows hand cutting. A No. 6 cutting tip is used (cutting-oxygen orifice: 53 drill size). Oxygen pressure is 25 psi, and air pressure for the powder is 30 psi. Cutting speed is about 8 ipm.

Figure 6 shows the relatively smooth surface that is obtained after the cut. After removal of "drippings," only light grinding has to be done to prepare the part for fit-up and subsequent welding.

Straightline machine cutting is illustrated by Figs. 7 and 8. The machine in Fig. 8 travels on a track to trim off $\frac{3}{8}$ inches from a 321 stainless plate $\frac{5}{8}$-in. thick. The heavy-duty torch uses a No. 4 cutting tip (cutting-oxygen orifice: 60 drill size). Oxygen pressure is less than that of the hand torch—18 psi as compared to 25 psi—but cutting speed is greater. With the machine, straight-line cutting can be done at a speed of 12 ipm—an increase of 50% over the speed of the hand torch. Irregular and circular cuts are made by a shape-cutting machine, not shown in these pictures.

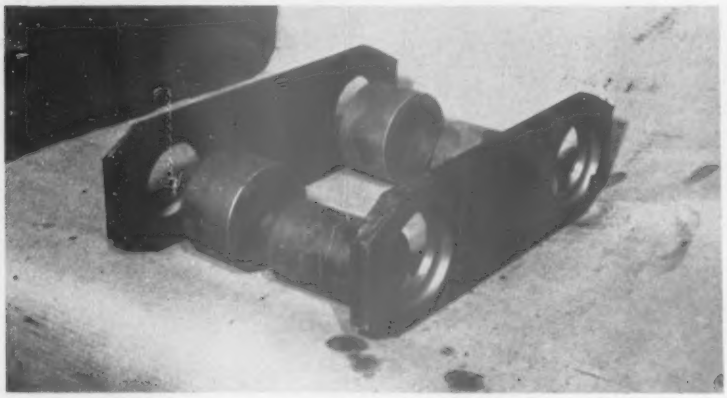
Figure 8 shows the clean edge of the machine-cut plate after slag removal.

Chain Links

Even though it is now making heavy weldments for the Navy, Silver Engineering Works is primarily a manufacturer of machinery to process sugar beets. The growing of drab, ugly looking beets and their transformation into sugar that can't be detected from cane sugar is one of Colorado's major industries.

Figures 9, 10, 11 and 12 show steps in the submerged-arc welding of chain links for sugar-beet han-

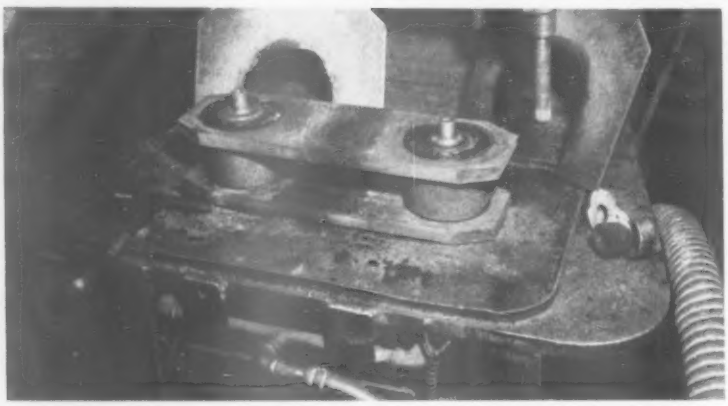
Water cooling while welding . . .



9—"EXPLODED" view of chain link for sugar-beet handling equipment shows the various parts that are welded and the way they are assembled

10—HOLDING fixture for the links and the facilities for water cooling

11—ECCENTRIC guides the rod feed in a 3-in. circle during the welding



12—WELDS are done, but plugs have not been knocked out of the hollow pins. Chain link will be turned over and welded on its other side.

dling equipment. This job is unusual because the links are water cooled during welding in order to prevent loss of hardness of heat-treated roller bushings.

The "exploded" view (Fig. 9) shows the link parts that are to be welded. Each of these roller chain links is made up of six pieces: two link bars (¾-in. mild-steel plates), two hollow pins and two hardened roller bushings. The pins go through the bushings and fasten together the two link bars. The pins are welded to the link bars, but the bushings are left free to rotate. The problem of assembling these parts is one of retaining the high hardness of the roller bushings while welding the pins to the link bars

The hollow pins have a wall thickness of ⅜ in. They are pressed into holes of 2 15/16-in. diameter drilled in the two link bars. Weld grooves are machined in these holes before the pins are pressed into place. The pins extend not quite through the thickness of the plates, leaving "wells" to be filled with deposited metal.

Two plugs cork up the hollow pins during welding. It is the purpose of these plugs to confine the cooling water to the inside of the pins. A foot-pedal control draws down the plugs when the water is forced up from below.

Figure 10 gives us a view of the holding fixture and water-cooling facilities. As welding progresses, the water falls back into the tray underneath the holding fixture. The water keeps down the temperature of the pins and also limits the time at high temperature so that heat is not transferred from the pins to the bushings during welding. The roller bushings are thus enabled to retain their heat-treated hardness. Since the bushings can rotate freely on the pins, the wear is distributed over the entire surface of each roller (bushing).

In Fig. 11, welding is under way. The motor that can be glimpsed near the operator's head turns an eccentric that guides the rod feed in a 3-in. circle. A short radius rod connects the rod feed to an axle on the plug in the top of the pin being welded. The carriage-mounted welding head swivels freely besides being able to move back and forth on its track. Shelves hold the flux in the weld area. As welding progresses, the operator knocks off the slag at the start of the weld so that the end of the weld can be made to overlap its beginning.

Figure 12 shows the completed welds before the removal of plugs from the pins. The chain link will be turned over and welded on the other side, after which a light grinding by machine will remove the slight build-up of weld metal.

* * *

Photos and data courtesy of Linde Air Products Co.

FRONT Special pipe guard helps oil exploration vehicle to push through the thorny growth of East Africa

BACK Twin tanks in truck bed each carry 170 gallons of water or gasoline

How a Weldor Built a Desert Wagon

No roads, no filling stations and no water are apt to cramp the style of any truck. Nevertheless, one was designed that would meet these difficult conditions.

BY ELTON STERRETT

EXPLORATION to find oil-bearing areas calls men and machines far from civilization and its comforts. Perhaps as far-flung as any of these searching parties is one that is now operating in Italian Somaliland in the desert country of East Africa. The center of the exploration district lies some 480 miles from the nearest seaport, and there are no roads nor any means of communication. Not only must the expedition be self-dependent, but each unit of it must be able to carry enough supplies to operate far from the headquarters camp.

To add to the difficulties, water holes are widely spaced, and most surface water is unusable by man or machine. Hence each truck must carry water to support its crew and to provide replacement for cooling system losses. Since there are no filling stations, it must also carry fuel.

To provide these necessities, the weldor for the exploration company, Rogers Geophysical Co., of Houston, Texas, fabricated a tank that does triple duty as: (1) a frame reinforcement, (2) a storage unit and (3) the flat bed of the truck. The tank is made up of two squat T-shaped tanks that are welded together end to end to form a continuous unit the length of the truck frame from cab to rear cross member. The tank is welded to two channels, which serve as spacers between truck frame and tank bottom. The channels, in turn, are bolted to the truck frame as would be any standard truck body. The sides of the two tanks are sloped so they will clear the tires when the frame rests on the axle housing.

Water and Fuel Tanks

The two separate tanks welded together carry water and fuel. The water tank is positioned at the rear of the vehicle, while the fuel tank is in front. The bulkhead between the water and fuel tanks is formed of two abutting plates (ends of tanks) so that the contents of one tank will remain sealed from the other even should a leak develop through the seam in one tank.

The water tank is filled through a connection at truck bed level at the extreme left rear of the truck bed; the fuel tank is filled through a fitting at the right front of the bed. Water is drawn through a 2-in. valve on a nipple welded at the base of the tank, while the fuel supply is connected directly to the fuel pump.

On top of the two tanks goes a non-skid steel floor plate, made heavy enough to withstand the hard service expected to be met.

For further protection of the desert wagons on their long trek through trackless country, the front of each vehicle is guarded by a pipe rack. The pipe was formed to shape and welded into a unit. The pipe guard takes the brunt of it when the truck forces its way through heavy thorn growth, very frequently encountered. An expanded mesh section fits in front of the radiator grille as an additional safeguard.

Capacity of each tank is approximately 170 gallons. Arithmetic shows that each truck carries a liquid load —on starting out—of 1.4 tons in addition to the necessary exploration equipment. To carry this heavy load over rough terrain, special reinforcing springs were made and fitted.

Brazing

BY LESTER F. SPENCER
Chief Metallurgist, Landers, Frary & Clark, New Britain, Conn.

PARTS formerly produced as single forgings or castings are now being made of components that can be more easily and economically produced by stamping, simple forming or deep drawing. These are then joined by brazing, to each other and/or to tubular parts, ribs, screw machine components, etc. Decreased production costs, simplification of design, weight savings, increase of production potential . . . these are among the benefits that the process change has effected.

The adapter for an automobile shock absorber pictured at left represents an instance of this production trend. This item was previously made from a forging. The forged part (A) had a large pin welded on one end. The brazed design (B) has resulted in a reduction of about 30% in weight and 50% in cost with equal serviceability.

The rocker-arm shaft bracket for aircraft engines, also pictured at left, represents the replacement of a cast part by a fabricated part. This bracket is now being made of several stamped parts. Machine work has been reduced 50%; weight reduction is 25%, and the cost of producing the part has been lowered by 20%. The assembly is prepared for furnace brazing as explained in the text below the picture.

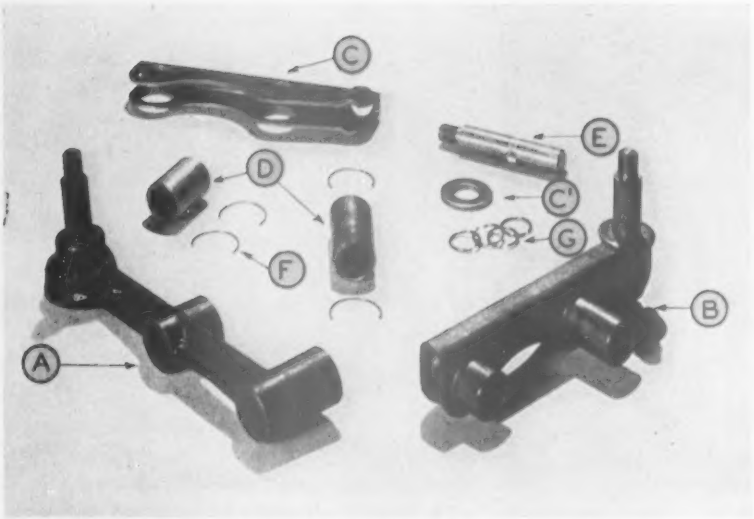
QUESTIONS AND ANSWERS

Brazing is quite versatile and may be used to join either similar or dissimilar metals. In order to utilize it effectively, however, it is essential to answer such questions as:

What are the characteristics of the metal or metals to be joined? In particular, how does the metal behave under the influence of heat?

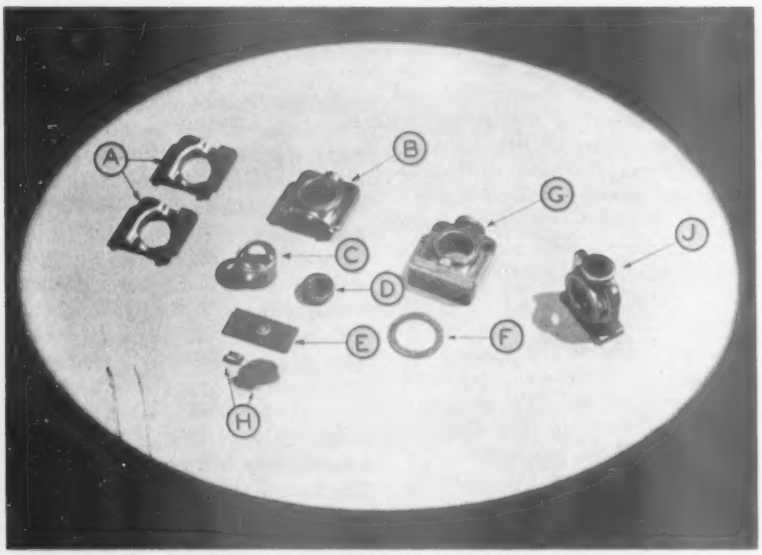
With the materials specified for brazing, what are the conditions under which a satisfactory brazed joint can be made?

What methods are available for the assembly of component parts? Production economies should be thoroughly studied on each proposed method of assembly—torch brazing,



Adapter for automobile shock absorber was previously made from a forging, as in (A). The forged part had a large pin welded on one end. New design (B) allows fabrication by brazing. The cut pieces of tubing (D) are placed in the body (C), which has been punched from hot-rolled steel strip. Half rings (F) of copper wire serve as the brazing alloy. The pin (E) has a loose fit in the punched holes of the washer (C') and the body; however the knurled portion of the pin gives a heavy interference fit. Alloy rings (G) bond the washer and pin to the body. Conversion to brazing was made possible by coöperative efforts of engineers at Metal Electric Processing Co. and Monroe Auto Equipment Co., Toledo, O.

Two Brazed Assemblies that Cut Costs



Rocker-arm shaft bracket for aircraft engine was formerly cast, is now made of several stamped parts. The two stampings (A) are spot welded together to form the body (B). Into the body is pressed a sleeve (C), an embossed disc (D) and two embossed plates (E) to form a base. The washer (F) is then pressed over the sleeve. The assembly (G) is prepared for furnace brazing by applying a copper slug and powder (H) at the joints. The finished assembly (J) is shown at the right. Courtesy Toledo Stamping & Mfg. Co., Toledo, O.

as a Production Medium—I

induction brazing, salt bath, furnace, etc.

What are the characteristics of the brazing alloy to be employed? Its limitations?

What are the advantages and limitations of the various methods of brazing?

It is the purpose of this article to give information that will help you to secure the answers to the above questions. The present installment will discuss various brazing alloys and brazing methods. The problems arising in connection with the brazing of specific materials will be defered to Part II.

Strength vs. Clearance

One of the most important requirements of a brazed joint is strength. The strength factor has been proved to be directly related to the clearance provided within the joint. Here is a specific example: a silver-brazed butt joint of type 302 stainless steel. The maximum strength of approximately 135,000 psi is obtained with a clearance of 0.0015 in. The strength decreases as the clearance value of the joint increases: at a clearance of 0.005 in., the strength of the brazed joint is approximately 100,000 psi; at 0.015 in., only 65,000 psi.

Similarly, in the brazing of the type of joint where a round bar is fitted into a bore, the strength of the brazed joint decreases as the clearance increases. An indication of the relation of strength to clearance is given by Table I (from *The Iron Age*, June 9, 1949). In the last three instances, the test piece broke at the collar while the joint remained intact. The test pieces were steel bars of ½-in. diameter that were fitted into bores to provide varying clearances. Brass was externally applied, and brazing was accomplished by immersion in a cyanide bath at a temperature of 1,742 F. The length of the brazed joint was ½ inch.

The clearance factor will vary in accordance with the metal combination to be brazed and in the type of joint; however, it can be stated as a general rule that the minimum clearance will offer the greatest strength values within the brazed joint and, in addition, will provide the maximum economy in the use of brazing alloy.

Cleanliness of the component parts to be brazed is highly essential. Such contaminants as grease, light oil or similar soil will prevent the formation of a good brazed joint. This type of soil can be readily removed by a vapor degreaser, or a caustic wash followed by water rinses may suffice.

Oxide formations are also objectionable; this type of contaminant is normally removed by the action of a pickling agent, grinding or shotblasting procedures. Normally, sandblasting is not recommended because the embedded silica particles may interfere with the wetting action of the brazing medium.

Of equal importance to cleaning is the maintenance of a clean surface during brazing. This is achieved in several ways: (*a*) by a protective atmosphere as is experienced normally in furnace brazing; (*b*) by the use of a protective medium such as molten salt or metal bath in which the joint is immersed and (*c*), by a fluxing agent, the method most commonly employed. The degree of protection required will depend upon both the material to be brazed and the type of oxide formation that may result during the heating cycle.

Fluxes and Alloys

The fluxing agent has another function besides cleanliness; namely, it will "wet" the material so that an even flow and satisfactory penetration (often referred to as "capillary attraction") can be realized. The previously discussed factors of cleanliness and joint clearance will have an important bearing on the degree of flow of the brazing alloy.

The composition of the flux will vary in accordance with the material to be brazed. Either anhydrous borax or a mixture of anhydrous borax and boric acid is widely used where the temperature is above 1,500 F and the brazing material is either copper or brass. Where a refractory type of oxide is formed, the alkali bifluorides in combination with either borax or boric acid are used for such alloys as stainless steels, aluminum bronzes, silicon bronzes and beryllium copper. These fluxes can be obtained in either powder, paste or liquid form; the former two types require mixing with either water or alcohol.

There are a variety of brazing alloys. The most common types are copper, brass, silver and silver-bearing alloys. Copper is usually used in the brazing of steel assemblies, but brass can also be used for joining the same materials. With a brass alloy, the loss of zinc through volatilization may prove troublesome. The loss of zinc from a brass alloy can be either eliminated or minimized by placing the alloy as a brass wire within the joint prior to heating.

The standard silver-bearing alloys contain silver in amounts varying from 5 to 80%, copper from 15 to 85%, zinc from 0 to 38% and may or may not contain other additives such as cadmium, nickel, phosphorus, tin and manganese. Melting points range from 1,095 F to 1,575 F, and flow points from 1,145 F to 1,805 F. Curiously enough, the alloy with the highest melting point is not the alloy with the highest flow point, nor is the alloy with the lowest melting point the alloy with the lowest flow point.

These alloys are widely used to join austemitic stainless steel, high-nickel alloys such as Inconel and Monel and non-ferrous metals and alloys including brass, bronze and copper.

Table I. Joint Strength with Varying Clearances

Clearance on Diam., In.	Load to Rupture in Tension, Lb
0.001	21,500
0.002	24,700
0.003	21,300
0.004	21,160
0.005	20,820
0.006	19,400*
0.008	14,800*
0.010	16,700*

*Test piece broke at collar; joint remained intact.

Oxyacetylene

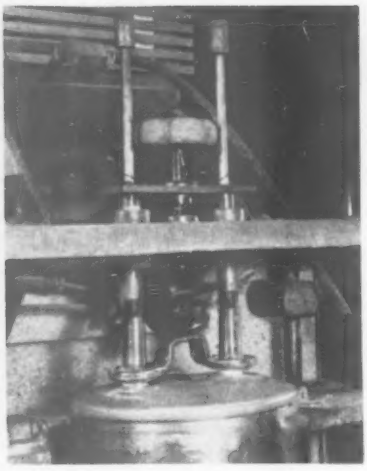
1—FIXED burners silver braze a flange and a plug in a thermal unit at a rate of 250 per hour

—Courtesy Handy & Harman

Carbon Tongs

2—SILVER alloy is fed by hand to heated area to braze 432 wire connections in an electric motor

—Courtesy Handy & Harman



Induction

3—TWO stainless-steel nipples are being brazed onto a stainless-steel head for a hot water tank

—Courtesy Vacuum Can Co.

The production man who wishes to use brazing has a wide choice. Besides the four processes pictured, he may also use resistance brazing and furnace brazing.

The choice of a silver-brazing alloy is made on the basis of melting point, color characteristics, joint strength and ease of application. In many instances, it has been found economical to use preformed brazing alloys. This is particularly true where the procedure can be placed on an automatic basis as in induction, salt bath and furnace brazing. Preformed alloys not only realize the most economical use but also result in joint uniformity. This holds true for copper as well as silver alloys.

Torch Brazing

Because of the low cost of equipment and its flexibility, brazing by the hand torch is a method very frequently encountered. Skilled help is usually required, and the operation is slow as compared to brazing procedures that can be placed on an automatic or semiautomatic basis. The comparatively higher cost per unit braze may not be too objectionable, however, where the production volume is low or where the design will permit of no other method of brazing. The oxyacetylene flame is the preferred source of heat since it offers the hottest flame and fastest heat. In some instances, a multitip burner or torch is used to advantage in securing better heat uniformity.

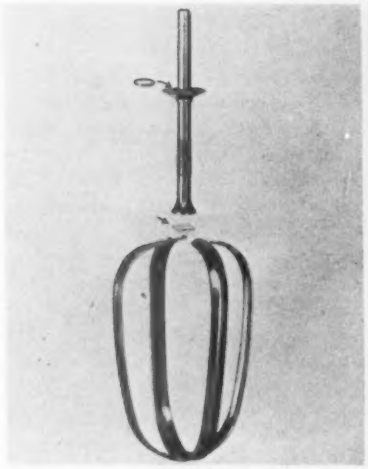
When production requirements are moderately high, it may be advantageous to put the torch brazing on a semicontinuous basis. Preplaced rings and inserts are usually used in this type of arrangement. The parts may be preassembled on a turntable by a helper and progressively brazed by the operator as the table rotates. The number of operators on a turntable arrangement will vary in accordance with the number of joints on a jigged assembly or the length of braze to be performed on the joints.

Another way is to arrange gas-air burners in tandem and place the parts to be brazed on a movable table. This table will travel between the two rows of burners at a speed calculated to allow the optimum time within the heating zone. Where circular joints are to be made, the assembly can be rotated as it passes between the burners. Brazing methods involving the latter two types of installations can only be performed on a symmetrically designed joint. The installation pictured in Fig. 1 utilizes fixed oxyacetylene burners to silver braze a flange and a plug in a thermal unit. The production rate is 250 pieces per hour.

Where either field repair or the brazing of a bulky item is involved, the versatility of the hand torch is a definite advantage. The use of a jig or fixture is mandatory for joint alignment and to minimize tensile stresses. The control of temperature is rather difficult and calls for experience and good judgment on the part of the operator. Copious fluxing is usually recommended for both the base metal and brazing alloy.

Resistance Brazing

The heat in resistance brazing is obtained by passing a heavy current through the joint. The amount of current is, of course, governed largely by the material to be brazed. For instance, the copper-base alloys, which have a low electrical resistance, will require large values of current as compared to metals of greater resistance and lesser conductivity. Resistance brazing is a very close relative of resistance welding. In many instances, the equipment consists of a converted spot welder. The standard copper electrodes are replaced by either carbon or molybdenum electrodes and the pressure applied is usually reduced to just below the arcing point. When the shape of the piece permits, it is possible to clamp the electrodes close to the surface, thereby limiting the heat close to the section to be brazed.



4—BLADE for mixer represents another application of induction brazing. Alloy shim is used to join blade and stem, and a ring joins batter guard to stem

—Courtesy Hunter Mfg. Co.

5—BRAZING 44 copper tubes to radiator manifold is done in one dip, requires less than 3 minutes

—Courtesy Ajax Electric Co., Inc.

Salt Bath

Most frequently encountered alloys for resistance brazing are the silver-brazing alloys; however, a copper-phosphorus alloy can be used for the joining of copper-base alloys. The brazing alloy can either be preplaced or can be fed by hand into the joint after the part is at brazing temperature; in many instances, the latter method is preferred. Though fluxing should be done, it is necessary to avoid a complete coating since metal-to-metal contact is required for successful brazing. Heat input is controlled by the application of intermittent current, which balances the heat throughout the joint until the proper temperature is reached. A definite control of temperature, such as is achieved by either furnace or salt bath, is seldom realized.

Incandescent Brazing

In the incandescent method of brazing, the heat input is developed by a brazing block heated by the current from a welding transformer. This method is thus a form of resistance brazing. The brazing block presses against the joint, and the heat developed in the block performs the braze through conduction.

Material for the brazing block will depend upon the pressure necessary to perform a satisfactory braze. A graphite block heats quite rapidly, but is not recommended where unit pressures exceed 200 psi. The kva rating depends upon the size of the block as well as its material. A graphite block measuring ½ by ½ by ¼ in. will heat quite rapidly with a 20-kva capacity, while a graphite block 1 by 1 by ½ in. may require 50 kva.

Where unit pressures exceed 200 psi, the block can be made of a copper-tungsten alloy or even steel. The copper-tungsten block requires approximately twice the kva capacity for the same section as a block made from graphite.

Brazed joints of high strength may be produced by this method of joining. Portable incandescent brazing requires no jigging arrangement, and can be used where the workpiece cannot be moved to brazing equipment. A typical application of the carbon tongs is illustrated in Fig. 2. The tongs are clamped to the joint members with sufficient pressure to assure good contact and prevent movement during either the heating or the cooling phase. In this instance, the brazing alloy (a 50% silver alloy) was fed into the joint, and some 432 wire connections were made. The product being manufactured is a large electric motor.

Induction Heating

The induction method is widely used where material and design will permit a localized braze and is, in many instances, the preferred procedure where certain mechanical properties within the base metal are to be retained. Operation is simple: the prepared joint is merely placed in a field of high-frequency current, resulting in a rapid localized heating of the sections to be brazed.

This method eliminates, to a large extent, both distortion and excessive annealing of adjacent areas. Brazing by induction must proceed with caution, however, where strain-hardened material is to be joined. It has been our experience that, in the induction silver brazing of 302 stainless steel, failures are apt to occur when the material has been severely cold worked during a sequence of drawing operations. The breakage, which occurred within the area of the braze either at the time of brazing or directly afterward, ran as high as 65%. Its cause was attributed to the too rapid relief of stress within the brazed area. The remedy was to anneal the drawn shells prior to brazing.

Induction brazing always requires a heating coil, which is usually made from copper tubing and is water cooled during the operation. The design of the coil will vary in accordance with the conditions of the particular problem. Thus either single-turn or multiple-turn coils can be employed, depending upon the magnetic field requirements. Circular, rectangular or spiral coil design may be employed, depending upon the shape of the brazed item. If internal brazing is to be performed, the coil design is of extreme importance as internal coils are said to be less efficient than external coils.

Induction brazing is quite popular. Of the brazing operations performed at Landers, Frary & Clark, induction brazing satisfies approximately 65% of all brazing applications within the plant. One instance is illustrated by Fig. 3: the brazing of two stainless-steel nipples onto a stainless-steel head for a small hot water tank. The conversion to induction brazing brought about a 50% increase in production, a 25% decrease in rejections and the production of more uniformly strong joints.

Almost all that the operator has to do is place the tank head with nipples and preformed silver-alloy rings on a supporting drum. A foot-actuated cylinder raises the tank head into position and automatically turns on the heat. At the end of the brazing cycle, the brazed assembly

Table II. Typical Constituents and Cost of Furnace Atmospheres

Type of Atmosphere	Used to	Dewpoint °C	Costs*	Analysis, % H_2	CO	CO_2	N_2
Lean exothermic gas	Silver-braze copper and brass	Room Temp.	$0.10	0.5-1	0.5-1	11-12	87
Rich exothermic gas	Copper-braze and silver-braze low-carbon steels	Room Temp.	$0.12	14-15	9-10	5-6	70-71
Monogas	Copper-braze and silver-braze med. and high-carbon steels. Copper-braze Monel and nickel	—40	$0.15	15-16	10-11	—	73-75
Endothermic gas	Copper-braze and silver-braze med. and high-carbon steels	—20	$0.35	38-40	17-19	—	41-45
Dissociated ammonia	Copper-braze and silver-braze stainless and high-alloy steels, Stellites, carbides, etc.	—60	$1.25 to $4.00	75	—	—	25

*Cost based on: Methane at $0.40 per 1,000 cu ft
Electricity at $0.01 per kw-hr
Water at $0.05 per 1,000 cu ft
Ammonia at $0.035 per lb in tank car lots
at $0.15 per lb in cylinders

Courtesy Westinghouse Mfg. Co., Pittsburgh, Pa.

is automatically lowered into an unloading position.

Induction brazing is also being used to replace rivets. One example is the food mixer beater shown in Fig. 4. In this specific application, six beater subassemblies are brazed simultaneously utilizing shims of silver-brazing alloy The first braze joins the stem and the blades, after which the power is automatically transferred to the second set of inductor coils, which braze the batter guard to the stem of each assembly.

Salt Bath Brazing

The molten salt in a salt bath serves two functions: (1) as a heat source and (2) to protect the assembly from oxidation during the heating period. Temperature uniformity is very easily maintained in the bath. Since heat transfer is by conduction, the time for brazing is from a fourth to a sixth that required in furnaces of the radiant-type. Hence the production realized per unit of occupied floor space is quite high.

Salt bath brazing is quite versatile, being used for the joining of steel, cast iron, brass, bronze, copper or aluminum assemblies. The selection of salt is dependent upon the material to be brazed. With the proper choice of salt, brazing can be combined with carburizing, or brazing and hardening can be performed simultaneously. In the latter case, a quenching procedure is involved directly after the assembly has been removed from the hot salt, and a simplified braze design is a prerequisite to avoid or minimize distortion. Preplaced rings of alloy are usual in salt bath brazing, and fixturing is often necessary to hold the assembly together. Certain types of joints can be mechanically assembled, thus eliminating the need for fixturing. To drive off any occluded moisture that might interfere with brazing, assemblies should be preheated before they are immersed in the salt.

Brazing can be performed continuously or by the batch. Several joints can be brazed simultaneously: in Fig. 5 no less than 44 copper tubes are being brazed to a radiator manifold in a single operation requiring less than three minutes. In this application, only that portion of the assembly to be brazed is immersed in the salt bath. Design should always be such that no hidden corners nor similar obstructions are present to prevent the normal drainage of salt after brazing.

Sealed containers are one item simply impossible to braze in salt; they are too buoyant to be immersed.

Furnace Brazing

The furnace method is widely used for either batch or continuous production of both ferrous and nonferrous assemblies. Multiple-joint brazing can easily be performed, and a dual operation of brazing and hardening can be done on air-hardening steels.

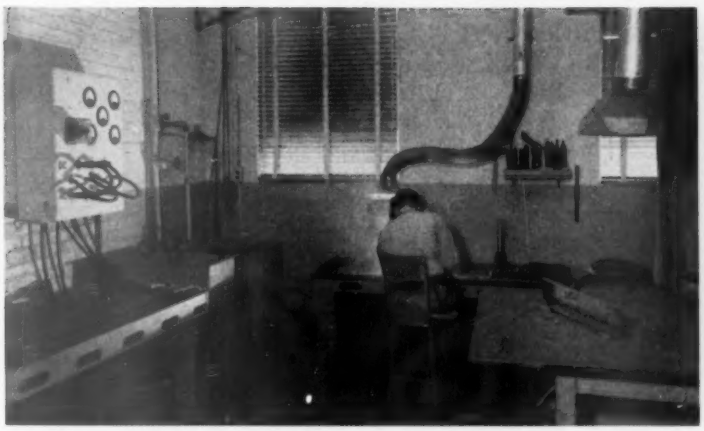
The choice of furnace is governed by five factors: (*a*) production requirements, (*b*) size and weight of the brazed part, (*c*) equipment costs, (d) cost of operation and maintenance, (*e*) versatility of equipment.

The batch-type furnace is employed where large sections are to be brazed or where production requirements are moderate The advantage of this type of installation is that it can be diverted to either annealing, normalizing, pack hardening or hardening by the heat-and-quench method. The initial investment cost of a continuous installation such as the mesh belt or roller conveyor furace is high. Continuous furnaces, however, have a reputation for high productivity and low labor costs.

Regardless of the type of furnace, a prerequisite of any furnace brazing is that a reducing atmosphere be maintained in both the heating and cooling sections of the furnace. Some types of atmospheres for specific applications are given in Table II.

As with other methods of brazing, design changes of items will permit the substitution of pressed and machined components for larger parts that were formerly forged or cast.

Part II, of this article, to be published in an early issue of The Welding Engineer, *will discuss the brazing of specific materials: aluminum, copper-base alloys, carbon steels, stainless steels and high-nickel alloys. Some suggestions on joint design will also be given.*



WELDING shops handle electrode research and development programs

SPECIMENS and film over cobalt-60 pit

New Lab for Electrode Research

COMPLETION of a new $50,000 research building at York, Pa., marks another step forward in the expanding use of research by the welding industry.

This new research laboratory, a one-story brick building, is located adjacent to the York plant of The McKay Co. The building provides more than 3,000 square feet of floor space for offices and laboratories. The research staff is under the supervision of W. T. DeLong, chief metallurgist. The laboratory area is subdivided into three operating sections: Welding, Coatings and Metallographic.

Welding Section

The Welding section consists of two independent welding shops. Operation in one area is confined to production control and to problems directly associated with electrode manufacturing, while activities in the second area are related directly to the various research and development programs. Besides a variety of conventional welding machines, flame-cutting and automatic welding equipment, the welding areas are equipped with a cold box for maintaining test assemblies at subzero temperatures, gastight chambers for welding in controlled atmospheres, an oscillograph and arc timers.

Coatings Laboratory

Most of the work that finds its way into the Welding and Metallographic sections originates as experimental electrodes in the Coatings laboratory. Equipment of this laboratory must provide for raw material storage, mixing, extrusion and drying.

Raw material storage is as complicated as that of any chemical storeroom. The coating of a welding electrode may be a balanced mixture of organic material, inorganic silicates and carbonates, simple and complex oxides, ferroalloys or powdered metals and liquid silicates. The Coatings laboratory must have working samples of all of these production materials plus numerous other materials being investigated. All samples must be arranged in a systematic order for instant use.

Maintenance of an adequate supply of core wire presents another problem. The Coatings laboratory must be able to supply all types and sizes of current production core wires plus an adequate selection of other types of core wire not considered usable from the production standpoint.

Adequate mixing and homogeneity are essential for uniform operation of welding electrodes. A battery of mixers is installed in the Coatings laboratory, including double-muller, screw auger and rotating blade mixers similar to those used by the baking industry.

Two individual wire feeder and extrusion presses are available for experimental coatings. A third extrusion unit is under construction. This latest unit will have mechanical conveyors and brushing equipment similar to production equipment.

Though it is difficult to simulate production driers in the laboratory, combinations of drying temperatures and drying times may be selected to approximate commercial conditions. Two forced-air gas-fired ovens and two static atmosphere electric ovens are utilized. Drying temperatures as high as 1,800 F are employed. However, if the coating contains any quantity of organic material, the maximum drying temperature should not exceed 275-300 F.

Metallographic Section

The activities of the Metallographic section are subdivided into two fields; namely, non-destructive testing and routine metallographic preparation for microscopic examination and evaluation.

Non-destructive testing is done using cobalt-60 as the radioactive source. All testing of this type is conducted in a walled-off area designed to protect the personnel from radioactive radiations. Electronic survey meters are used to measure the intensity of radiation inside and outside the restricted area. Darkroom facilities are available for the development of radiographs.

Standard equipment is used in the preparation of metallographic samples. The polished specimens may be examined at selected magnification using a Leitz vertical metallograph. Micro-hardness equipment is available for determination of the hardness of individual constituents in a weld-metal matrix.

1—MATERIAL received from the mills is sorted and piled on skids to be consigned to the fabricating shop

2—FABRICATING shop. Front to rear: layout area, flame-cutting, punches, fitting area, painting skids

How to Build

Unless you work for a structural steel company, you probably won't know all that has to be done when a bid is invited and accepted for a steel-framed structure.

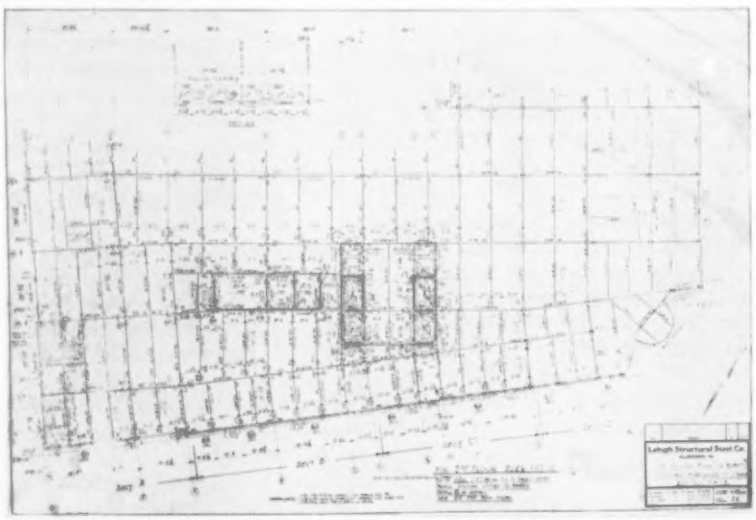
BY C. L. KREIDLER
Chief Structural Engineer, Lehigh Structural Steel Co., Allentown, Pa.

IN 1885, the 10-story Home Insurance building at the southwest corner of LaSalle and Adams streets, Chicago, was completed. This building, no longer in existence, was the first truly skeletal building. The frame consisted of serial column-and-beam construction, made up of round cast-iron columns, wrought-iron box columns of built-up section and wrought-iron I-beams. Lintels and mullions were cast iron. The outermost floor beams carried not only their portion of the floor load but also one bay of the exterior wall, up to the beam next above. This method of carrying the outer envelope remains the standard practice for tall steel-framed structures. Without this technique, the skyscraper would be impossible.

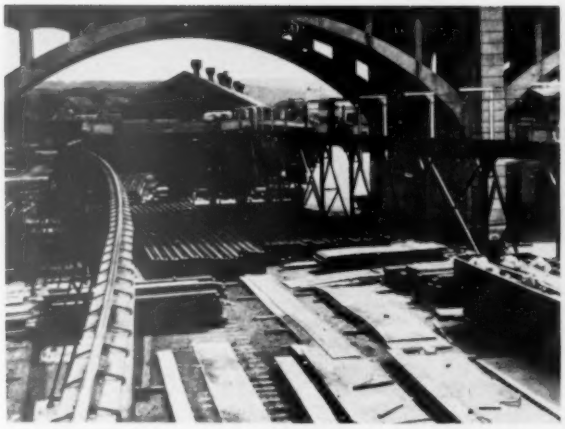
How a Steel Co. Operates

Each structural steel company has a different organization method for estimating, bidding contracts, preparing shop drawings and fabrication. The smaller companies operate one plant and a general office that performs all the fuctions of the business. The larger companies operate several plants and various offices. Whether the company is large or small, however, the functions may be classified into twelve departments.

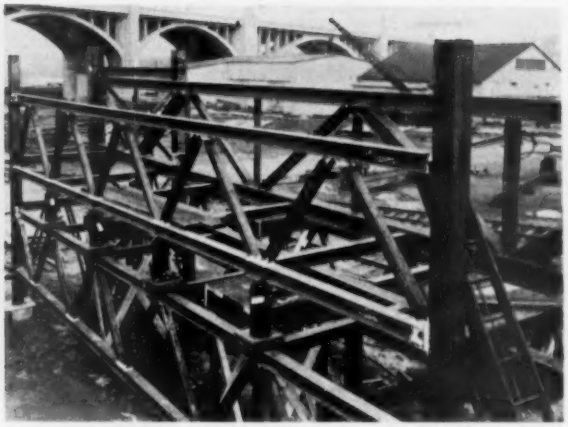
The contracting department (1) submits bids and takes contracts. The engineering department (2) prepares designs, makes estimates of weights and costs and supervises the work of the plant engineers. The drafting department (3) requisitions the materials to perform the contract and prepares the working drawings. The operating department (4) performs the various operations specified on the shop drawings. The auditing department (5) invoices the customers and compiles data of cost and accounts. The purchasing department (6) buys all materials and supplies. The treasury department (7) approves the credits of prospective customers, collects bills, pays indebtedness and disburses salaries and wages. The erecting department (8)



5—FRAMING plan, prepared from design drawings, tells what structural members are needed. This is for second floor of Jordan Marsh store, Boston



3—SHIPPING yard, from which fabricated steel is dispatched to field sites. Note the curved craneway



4—INSPECTION and testing. The arrangement shown is to apply hydraulic load to a pair of roof trusses

a Steel Building

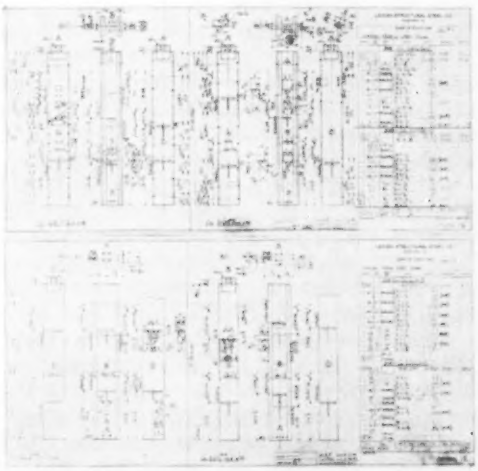
erects the fabricated structural steel in the field. The mechanical engineering department (9) deals with all problems pertaining to the fuel, power and machinery of the plant. The traffic department (10) issues instructions for the routing of shipments, furnishes instructions for shipping clearances, investigates shipping rates and adjusts claims with shippers. The personnel and public relations department (11) handles relations with the public and welfare matters of the employees. The safety department (12) is a very important department, whose functions scarcely require description.

Preparing of bids is the first step toward securing a structural steel contract. The engineering department estimates the cost from plans and specifications prepared by architects and engineers and selected by the contracting department. The majority of contracts are taken on a unit price or lump sum basis. Both types of estimates are composed of the same elements: cost of the raw material, cost of direct shop labor, general expenses of operating the shop, and cost of drawings with overhead expenses. To these estimated costs are added shipping charges, insurance, taxes and miscellaneous items.

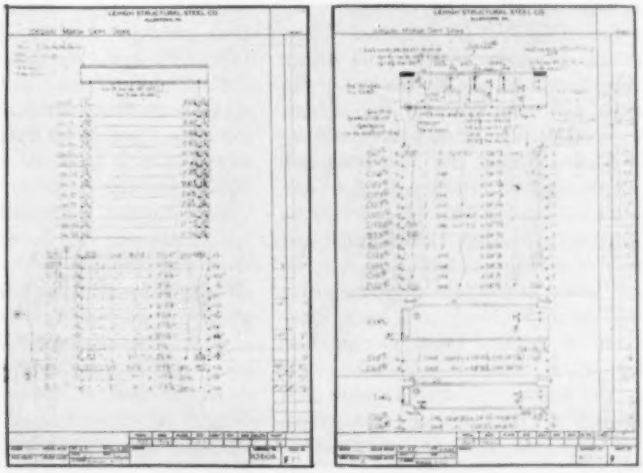
The contracting department adds a margin to the estimated cost and submits a proposal to the customer giving selling price and delivery date. The latter is especially important. The time of delivery frequently determines who will be the successful bidder.

Making the Drawings

When the contract has been awarded, the designs, specifications and pertinent information are released to the drafting department for the preparation of detail drawings. Good designs, specifications and complete information without subsequent re-



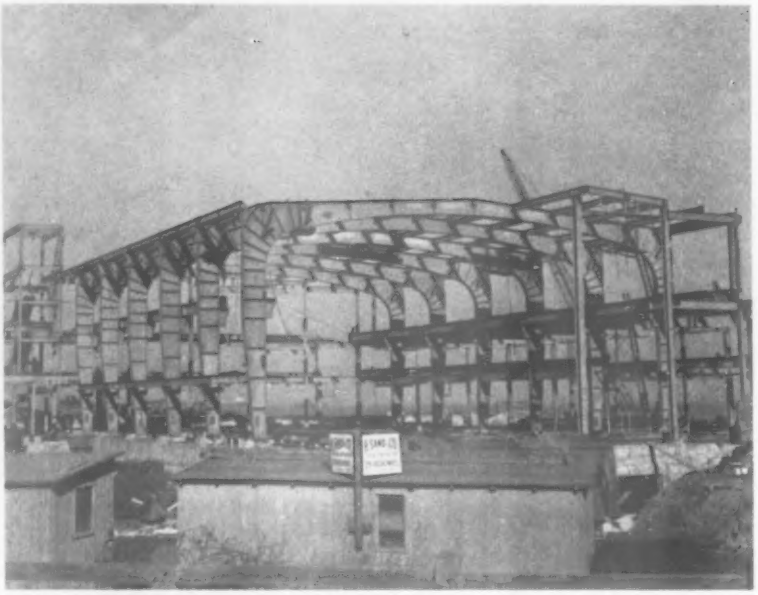
6—COLUMN details for Jordan Marsh department store tie into the general framing plan



7—BEAM details also tie into the framing plan and supply information that will be needed for fabrication of the members

visions are the ideal conditions for making detail drawings. Permit me to emphasize: good designs, specifications and complete information without subsequent revisions are the ideal conditions for making detail drawings quickly and economically with the least chance for errors.

A steel structure is similar to a gigantic jigsaw puzzle. The drafting department must devise an identifying system for each piece so that the erection department will be informed how and where to place each element. At the outset, the types of connections, the location of shop and field joints, the connection medium—bolts, rivets or welds—and the sequence of erection must be determined. All material that goes into the completed structure must be requisitioned from the purchasing department by the drafting department. The drafting department also prepares preliminary bills of material for the use of the purchasing department.



8—SUCCESSFUL erection depends upon the careful planning that went before. These welded frames are for a New York City sewage disposal plant

Each piece of main material is ordered from the rolling mill to exact size. In these times, it is imperative that material be ordered promptly in order to keep the fabrication shop operating and to meet erection schedules. Design changes will greatly complicate the material situation and are to be avoided wherever possible.

From the design drawings, the drafting department prepares a framing plan (Fig. 5). This is very similar to the design drawing except that typical connections and identifying markings are added. This drawing is diagrammatic to a small scale. With the plan serving to identify the pieces, column details (Fig. 6) and beam details (Fig. 7) are prepared. These details are schematic and not drawn completely to scale. However, the shop men and the structural draftsmen understand what is required.

Girder details are also prepared. All of these drawings will give complete information for identifying the shipping piece, the description and size of all the material that is to be assembled to form the shipping piece, the weight of each item and whatever information may be required for fabrication.

The fabricator's drawings are submitted to the customer's engineer for approval. The engineer's examination depends upon his personal preference. Some make a complete check, but most engineers are content with checking the general design, size of material used and the strength of the connections. The structural company is responsible for the correctness of the shop drawings; the engineer's approval is merely the authority to proceed with the fabrication.

Shop and shipping bills are prepared from the approved detail drawings by the operating department. The shop bills contain a list of all the members on the contract. This list includes: the material used to fabricate each member, the weight of each individual piece of material, the weight of the completed member, a list of the mill material with order item numbers. The latter list shows (1) the lengths from which pieces are cut and (2) the sections that are taken from stock material. The shop bill gives the shop all the information it will need to fabricate all members included in the contract.

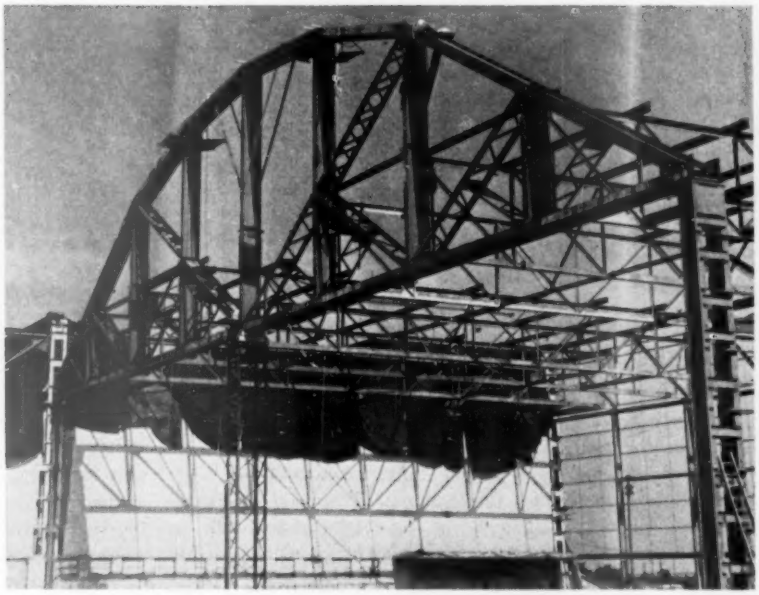
The shipping bills contain a list of all shipping pieces with descriptions and shipping marks. The overall dimensions of each member are given for purposes of identification, and weights are calculated. Actual scale weights are seldom used on structural steel contracts. Computed weights can be obtained before the members have actually been fabricated, which gives them a big advantage for the paperwork stage.

Shop organization, equipment and the routine of handling work will vary for different operating departments. The usual plan is to have a large structural shop and a small auxiliary shop for fabricating light material. Other buildings may be devoted to machine work, forge work and such other departments as are required for the plant production. The equipment is located so that material moves progressively from the receiving yard to the shipping yard with the least handling of the material.

Various methods and devices are used for locating holes and cuts on the steel. Generally this is accomplished by the use of templates or by marking the steel directly from the drawings—a process called "scratching." The template is usually made of wood or cardboard to a full-sized scale.

During the time that the drawings are being prepared and the templates made, the material is being received from the mills. As it is unloaded, each item is checked against the mill orders. The material is sorted and piled on skids (Fig. 1) for later consignment to the fabricating shop.

"Laying out" or marking the material is the first operation in the fabricating shop. The layer-out uses templates or scratches the steel. Also, he paints the assembly mark, the contract number, and other information on the steel. Before the steel leaves



9—CAMELBACK truss to support roof and monorail cranes in an aircraft factory. The all-welded truss spans 200 ft, has a rise of 40 ft at midspan

the layout skids, cuts and copes are usually made on it by flame-cutting.

From the layout skids, the steel moves to the punches and drills. There are many special machines for punching and drilling. After the detail pieces and main material of a member have been punched, the next operation is that of "fitting" (assembling) the various parts of a member. All of the pieces are fitted by direct reference to the shop drawings. The main sections are identified by the description that the layer-out has painted on the steel. Fitting up is probably the most difficult and responsible of any work in the structural shop.

Shop connections are either welded or riveted—bolting may be used on secondary connections. Three general classes of riveters are in use: stationary riveters, portable riveters and hand riveters. Virtually all welding in building construction is performed manually by the shielded metal-arc process.

The next operation is to clean the fabricated members of dirt, scale, rust and foreign matter. Scrapers, brushes, shotblasting, flame-cleaning and even chemical baths may be used. Painting comes next; many different kinds of paint are applied for particular purposes. If the steel is to be encased in concrete, it may be shipped to the site unpainted since concrete adheres better to unpainted steel. Steel that is used to support electrical equipment is often galvanized (a process of coating steel with zinc spelter) to resist corrosion.

Fig. 2 is a general view of a fabricating shop. In the foreground is the layout area, followed by the punches, fitting area and (at the far end) the painting skids.

The fabricated steel is transferred from the shop to the shipping yard to be dispatched to the field for erection. Figure 3 shows part of the shipping yard at Lehigh Structural Steel Co. in Allentown, Pa. Your eyes do not deceive you. The craneway in the foreground *is* curved. In order to move the steel directly from the shop through the bridge arch, an S-curve craneway was designed.

The correction of errors in the field is a very expensive matter. That is why inspection to maintain accuracy and quality is very important all through the fabrication process. The structural companies have their own inspectors as a safeguard against errors. In addition, purchasers of structural steel usually employ outside inspectors to see that specifications and plans are adhered to in the rolling and fabrication.

On special contracts, the engineer may require special inspection or testing. Figure 4 shows an arrangement for testing welded roof trusses. By using hydraulic jacks between a pair of trusses (top truss is inverted), 150% of the design load was applied to the trusses. The observed center deflections of the trusses checked with the calculated deflections, and the original joint designs were adopted without alteration. The same trusses are now in service in the completed building.

Steel Erection

The erection department is the last department to handle the steel physically. The erectors are the ones who put on a spectacular show for the sidewalk superintendents. Erectors have a choice of a large variety of hoisting equipment. They follow the drawings prepared by the drafting department to place the fabricated pieces in their assigned places in the structure. The members are finally welded, riveted or bolted into place. We will not go into the comparative advantages of these three connecting processes. I would, however, like to show you two steel structures that have distinguishing features.

Figure 8 shows welded rigid frames for the girt chamber of the Owl's Head sewage disposal plant in New York City. This project has many novel features. The rigid frames in the photo span 66 ft, have a 23-ft rise and weigh 6½ tons each. The column section is 20 in. deep at the base; the knee is 4 ft 9 in. deep, and the beam section is a 30WF172. The knee and column web is ½-in. plate, and each flange at the knee is composed of a 16 by 1 1/8 in. plate and a 14 by 1 1/8 in. plate.

Figure 9 shows a camelback truss that supports the roof and monorail cranes in an aircraft factory addition. This all-welded truss spans 200 ft and has a rise of 40 ft at the midspan. The bottom chord is 36 ft above floor level. The main members are 36WF sections with the webs parallel to the ground line. The truss was raised in half sections, one-half the truss weighing 37 tons. To the verticals of this truss are connected parallel chord trusses that have a span of 125 ft. When the center tee is placed to complete the truss, the total weight jumps to 84 tons. The final structure provides a building that has a clear aisle of 200 ft with wall column centers at 125 ft.

In order to provide a structure that is incombustible and has the qualities of strength, compactness, salvage value and speed of erection, build with structural steel.

Up Hill . . . . . and Down

Facts You Should Know About Slope Control

BY STUART ROCKAFELLOW
Chief Engineer, Robotron Corp., Detroit

SINCE resistance welding occurs within a fraction of a second, heat is generated very quickly in the weld. The force that acts upon the electrodes must be high to follow the work as fast as heat is generated. High electrode force means lesser resistance and hence less heat.

A slow build-up of heat would enable the electrodes to follow the work with a lower electrode force. This would increase the resistance and hence generate heat in the welded area with less current flow. Less power could be used.

Suppose that the first half-cycle of current is at 20%, the next half-cycle at 30%, the next at 40% and so on until the current has built up to the required heat value. This is the sort of thing that we call slope control. It is up-slope control if it regulates the rise of weld current at the start of the weld, down-slope control if it regulates the decay of current at the end of the weld cycle.

Up-slope control is designed to meet the specifications of weld preheat, to prepare the metal for welding. The first application of heat, at low value, can be made to burn off the impurities and oxides that impede current flow and so cause nonuniformity in welds.

Down-slope is desirable after the weld is made. This gradual heat decay can be made to accomplish remarkable things. As one example, high-carbon steels such as 1060 and 1080 are difficult to resistance weld without cracking. When this material is chilled rapidly, it becomes brittle. More gradual decay of heat, accomplished by down-slope control, allows slower cooling of the heated metal and ends the cracking difficulty.

UP-DOWN CONTROLS OFFERED

Automatic controls for both up-slope and down-slope are available. Now on the market is a non-synchronous, single-phase control that offers the simplicity of a single-phase circuit.

With proper up-down slope control, galvanized steels can be successfully spot welded. The up-slope control is used to melt the zinc coating (which has a higher resistance than the steel). Under ordinary welding methods, the initial heat is too great for the zinc, which spews out between the electrodes. With up-slope control, the zinc melts gradually and flows away from the electrodes during the up-slope period. After the weld, the down-slope control cools the sheet slowly, allowing the zinc to flow back into place and repair the damage to the coating.

Another example pertains to seam welders. When work is inserted in the throat of a welder, a decrease in heat occurs because of the magnetizing forces added. Seam welding of a round steel tube could be accomplished by gradual withdrawal of the tube from the throat of the machine if down-slope control were available. Full heat would be applied at the start of the weld, and the heat would be gradually decreased as the tube is withdrawn from the throat. The control could be adjusted to compensate for heat increase caused by withdrawing steel from the welder throat.

In the opposite case—when steel tubing is fed into the throat—the up-slope control could be used. Low heat would be applied when no steel is within the throat, and the heat gradually advanced as the tubing goes farther into the throat.

Many applications require the welding of dissimilar metals such as stainless steel to carbon steel, brass to stainless, aluminum to brass, etc. While the up-down slope control is not a cure-all, many jobs impossible to weld by conventional methods have been successfully handled by this means.

How Slope Control Operates

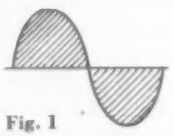


Fig. 1

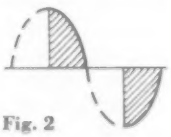


Fig. 2

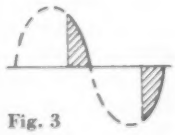


Fig. 3

WITH ANY type of electrode control for resistance welding, the current flowing to the transformer secondary (welding current) must first pass through a group of ignitron tubes. These are large tubes that are filled with mercury vapor when conducting. Since ignitrons are gas-filled tubes, only the point at which they begin conducting can be controlled.

Ignitrons firing at the start of a wave give full current or heat to the weld, as diagrammed in Fig. 1.

Ignitrons delayed in starting (Fig. 2) give about half current to the weld.

Ignitrons delayed still more (Fig. 3) give even less current to the weld.

What controls the firing point of the ignitrons? This is usually accomplished by other electronic tubes called thyratrons, which are in turn controlled by a simple phase-shifting means. Now see the next page.

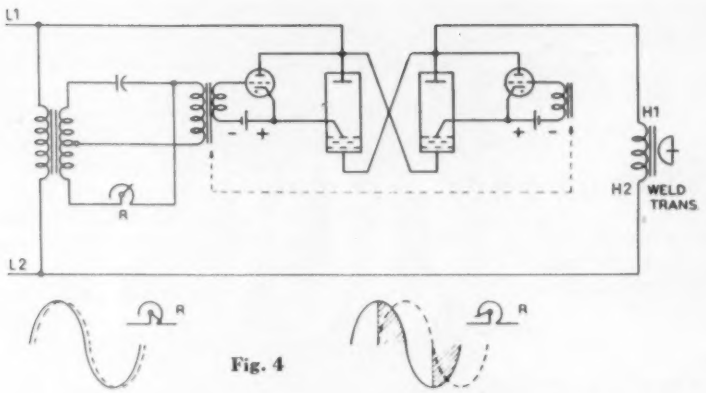


Fig. 4

IN FIG. 4, the phase-shift network controls the voltage wave at which the thyratrons are allowed to fire. If the variable resistance R is completely shorted, the voltage to the thyratron grids is in phase with the line voltage, and ignitrons are allowed to fire at nearly full current as in Fig. 1. When the variable resistance R is maximum, the voltage to the thyratron grids is shifted to delay the firing as in Figs. 2 and 3.

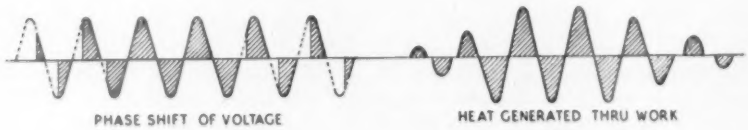


Fig. 5

Fig. 6

IN FIGS. 5 AND 6, we see how phase shift of voltage, to control firing of thyratrons and ignitrons, affects the heat generated through the work.

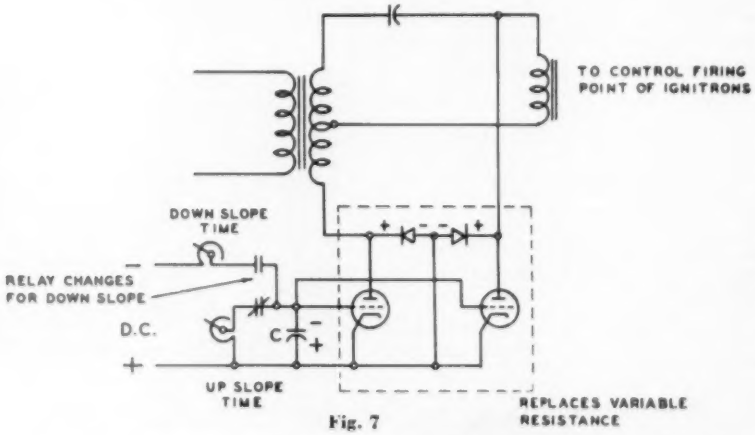


Fig. 7

VACUUM TUBES create a variable resistance to delay or advance firing.

If the operator could *manually* start the weld with the resistance at a maximum, the ignitrons would be delayed on the first half-cycle and would fire late in the wave, causing low heat. Then, as the weld progressed, if the operator could *manually* decrease the value of resistance, each succeeding half-cycle would be allowed to fire sooner until full heat is generated in the weld transformer. This action is what we have called up-slope control.

If, after the weld, the operator could progressively increase the value of resistance (decreasing the phase shift) and thus cause more and more delay in firing, he would decrease the heat in the gradual manner needed for down-slope control

Of course, the operator cannot *manually* increase or decrease the resistance as needed to vary the current. The human eye, human nerves, human brain and human hand are simply not fast enough. The variable resistance that is needed to create a means of phase shift must be created by some automatic method

One way is to use vacuum tubes to create an effective variable resistance

In Fig. 7, a vacuum tube network has been substituted for the variable resistance R in Fig. 4. Each half-cycle of phase-shifting current flows through one tube. The grid bias on the vacuum tubes will effectively vary the resistance of the network. The control factor, therefore, is the amount of bias of the tube grids.

With zero bias (no grid voltage), the tubes will conduct fairly effectively (low value of resistance), causing the ignitrons to fire at full heat.

High negative bias on the grids of the vacuum tubes cuts down conduction, creating a high resistance that causes the ignitrons to be delayed in their firing and thus causes low heat through the transformer secondary.

All very well, but what changes the grid bias? The condenser C is the controlling factor.

If condenser C has been charged before the weld starts, a high negative bias is placed on the grids of the vacuum tubes. This means a high resistance in the vacuum tube network and delayed firing of the ignitrons. When the welding current starts, condenser C may be allowed to drain through some variable resistance so that the bias on the vacuum tubes automatically decreases. As the bias decreases, the vacuum tubes conduct more (less resistance), causing the ignitrons to advance their fire on each succeeding half cycle until full heat is finally attained.

The amount of resistance that is placed across the capacitor will determine how fast the capacitor drains. This will determine how fast the ignitrons get from low heat to high heat. In other words, it will govern the up-slope time.

Now what determines the down-slope time? After the capacitor has discharged, the ignitrons are conducting at full heat. A series charging source is connected to capacitor C to allow it to charge again, but at

(Continued on page 64)

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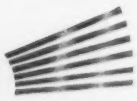

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a certain rate. As the capacitor charges, it again applies bias to the vacuum tubes, raising the resistance of the network. When the capacitor is fully charged again, the current to the welder is lowest. This is the action of down-slope control. A variable resistance may control the rate at which capacitor C charges to give selective time for the down-slope action. So we have put back our variable resistance again, but this time it is one that *can* be handled manually.

ADVANTAGES

A brief summary of the advantages of the up-down slope control would be:

Less power required due to lower electrode forces.

Lower forces mean less indentation of work, therefore better appearing welds result.

Less tip pick-up due to less flashing.

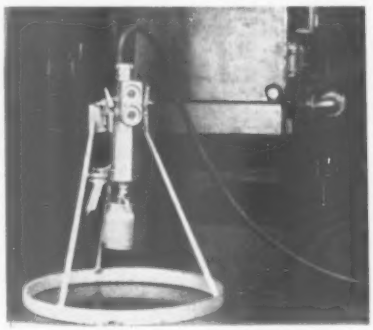
Longer electrode life due to lower forces and low pick up.

Less material cleaning required due to low initial heat that burns off impurities.

Less critical welding schedules because of consistency of heat action through up-down slope control.

Lower initial equipment costs.

* * *



Support for Dehumidifier

By Elton Sterrett

TO REDUCE the amount of moisture reaching a spray gun, a weldor made a handy tripod support on which a dehumidifier could be mounted. The support is heavy enough to stay where it is placed, and both lengths of hose can be coiled around the three sloping braces when the spray is not in use.

All it took was three lengths of $\frac{5}{8}$-in. round stock, a strip of 2 by $\frac{1}{2}$ in. strap bent into a circle and a bit of boiler plate. The picture above shows construction.

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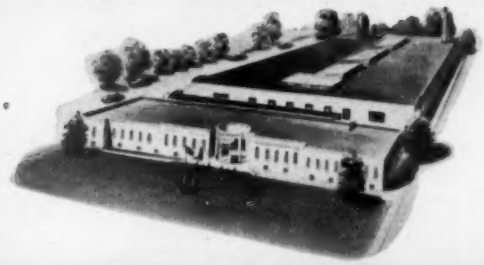

PRIZE COMPETITION FOR CONTRIBUTIONS TO THE SCIENCE AND ART OF "NON-FUSION" WELDING, BRAZING AND SOLDERING

Rules:

OPEN TO:
Engineers, Metallurgists, Research Investigators, Welders, Students, Faculty Members and all others qualified.

Covering technological and research aspects, procedures and applications of the use of lower melting (lower than parent) filler metals in the non-fusion welding processes.

The Jury and Committee of Awards:
1. Dr. Robert Humphrey, former Vice Chairman, American Society for Metals
2. Prof. Otto H. Henry, Dept. of Metallurgy, Polytechnic Institute of Brooklyn
3. Dr. Th. I. Leston, Vice President, Eutectic Welding Alloys Corporation

ELIGIBILITY

1. The Prize Contest is open to single individuals or groups of two or more, except employees of the Eutectic Welding Alloys Corporation, its subsidiaries and affiliates, its Advertising Agencies and its Distributors.

2. Each paper submitted must be original and previously unpublished. Moreover, each contestant must have actively participated in the work and preparation of the subject matter of the manuscript.

3. Participation necessitates submission of a paper of not less than 1,000 words, exclusive of drawings, specifications, tables, photographs, etc.

SUBJECT MATTER

1. The subject matter shall pertain to one of the following:

Classification A—*Basic principles, theory and results of research* in the field of "non-fusion" welding, brazing or soldering. (The metallurgical considerations of these processes may include Surface Alloying, diffusion, wetting, spreading, fluxing, equilibrium and non-equilibrium reactions, solidification, etc.)

Classification B—*Practical welding applications*—(The manuscript may be based upon the design or redesign of equipment, structures, and other products of ferrous or non-ferrous materials fabricated by "non-fusion" welding, brazing or soldering. Technical advantages of these processes and savings in material and labor should be considered and substantiated. Improvements in brazing and soldering techniques might also be the subject of the manuscript.)

2. Photographs, drawings, charts or test data which will add clarity to the presentation should be included.

SUBMISSION

1. Manuscripts should be typed in English, double spaced on 8½" x 11" white paper, with any drawing and photographs on separate sheets, preferably attached to the text. The manuscript should be securely bound and have a protecting cover.

2. Papers must be submitted in duplicate. One copy must be signed by the author (or authors) and enclosed in a separate sealed envelope, with the following information on the cover sheet (1st page) of the manuscript and on the outside of the envelope:

Name
Address
Signature
Company (or University) affiliation
Classification ("A" or "B") under which paper is submitted.

A duplicate of the paper, unsigned and unidentified as to author and application, should be enclosed in a second envelope.

The two envelopes should be placed in a large envelope and mailed to The Secretary, Prize Competition, Eutectic Welding Alloys Corporation, 172nd Street and Northern Boulevard, Flushing 58, New York, N. Y.

This procedure insures that all manuscripts are treated confidentially by the Jury. After the unidentified papers have been judged, the identification with the original paper on file with the secretary will be made and the prizes will be paid to the winners.

JUDGING

The papers will be judged by the Jury and Committee of Awards. In classification "A" the primary considerations are (1) originality, (2) understanding of basic principles, (3) merit of research results, (4) clarity of illustrations and data presented. In classification "B" the primary considerations are (1) originality, (2) material and labor savings, (3) improvement in efficiency and service life and (4) design and welding procedures.

Decision of the judges will be final. All entries and ideas become the property of The Eutectic Welding Alloys Corporation, and none will be returned.

CONTEST DEADLINE

All manuscripts have to be submitted and postmarked no later than August 31, 1953. Winners of awards will be notified approximately within (60) days after the close of the competition.

All communications and questions should be addressed to The Secretary, Prize Competition, Eutectic Welding Alloys Corporation, 172nd Street and Northern Boulevard, Flushing 58, New York.

Helpful suggestions on the preparation of the paper and on possible topics are available and will be sent upon request.

AWARDS

CLASSIFICATION A: Basic Principles, Theory and Results of Research		CLASSIFICATION B: Practical Welding Applications	
First Prize	$500	First Prize	$200
Second Prize	300	2 Second Prizes, each	100
Third Prize	200	3 Third Prizes, each	50
3 Fourth Prizes, each	100		
3 Fifth Prizes, each	50		

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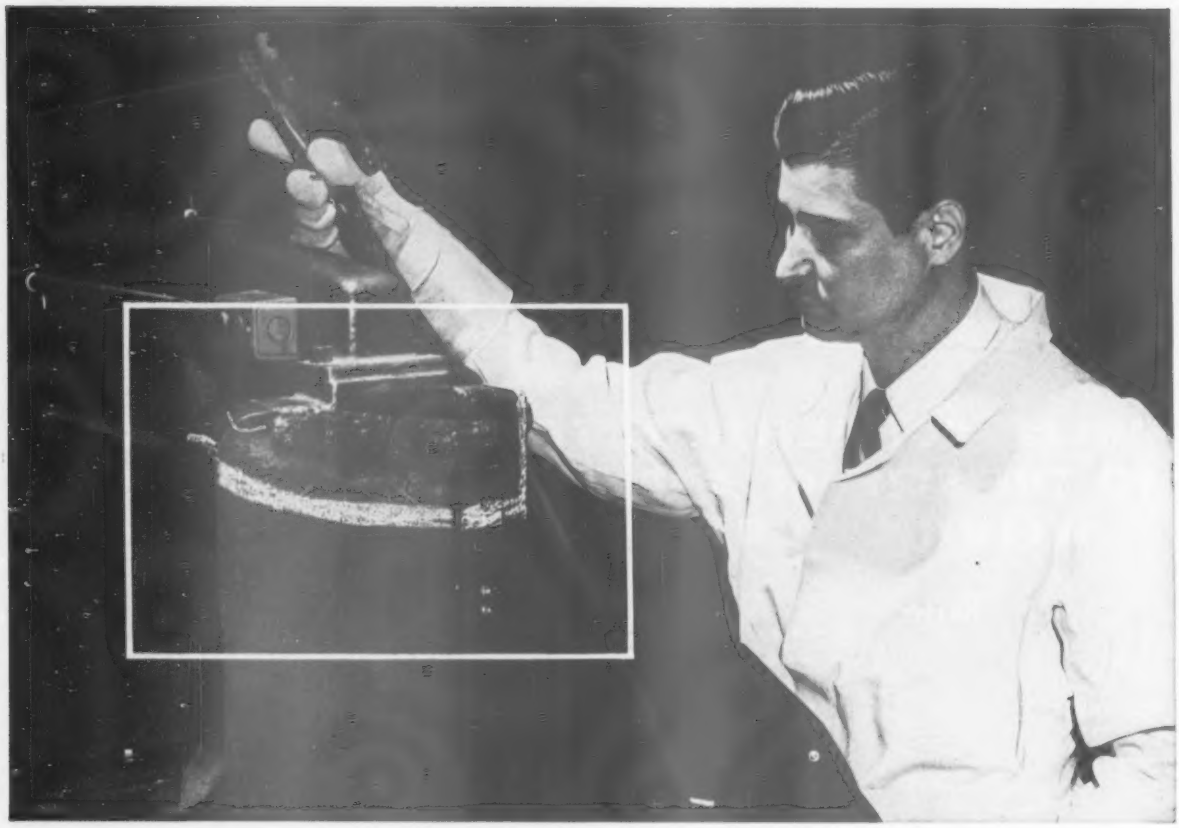

Bob Riegle, welding specialist for Williams and Co., Inc., of Columbus, Ohio, welded the shear support back into serviceable condition in 3½ hours using only 5 pounds of Ni-Rod "55".

Fractured on Friday

...back Shearing on Saturday

It was a black Friday . . .

The company's 8-ft. metal shear had broken in a freak accident.

It would take weeks to replace the part and would cost several hundred dollars.

Furthermore, the time couldn't be spared — the shear had to be always ready to handle emergency orders for cut-to-size pieces of metal.

What to do?

One of the company's welding specialists examined the gray cast iron shear support, and felt confident he could repair it.

Early Saturday morning he started . . .

First, he ground the fracture open to prepare the joint for welding. Then, using a ⅛" Ni-Rod "55"® welding electrode he laid the first bead. He carefully removed the slag and peened it — repeating this procedure until he had built up enough weld to go to a 5/32" Ni-Rod "55" electrode. He built the weld up above flush — — using five pounds of electrodes altogether.

The welding job was finished in about 3½ hours. The shear was back on duty Saturday — the welder had saved time and dollars for the company!

That's the kind of job welders are doing regularly with Ni-Rod "55" and usually without pre-heat or post-heat because it gives a sound, crack-free, non-porous weld. And Ni-Rod "55" is easy to use — it's stable-arcing with a minimum of spatter to give a smooth bead contour.

Consult your distributor of Ni-Rod "55" electrodes for the latest information on availabilities. Remember, too — it always helps to anticipate your requirements well in advance. And if you have a special cast iron welding problem, you can always call on Inco's Technical Service Section for help.

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Tensile Strength (lbs. per sq. in. x 10^3)	S	67.35	85.42	90.45	80.57	110.40	79.38	80.38	100.50	130.65			182.70						51.32.5
	R				80.61		75.40	90.50		110.70	156.97	103.85		110.95	50.70	100.90	65	60.70	50.32.0
	T		68.42	95.53	88.59				2.45	105.65									
Elongation (per cent in 2 in.)	S	3.40	4.50	4.60	9.5.48	3.55	4.35	5.50		2.40	2.45		4.5.53						4.47
	R				15.50			8.45		15.50	20.45	2.30		10.18	15	15	20	20	18.45
	T		6.42	7.50	12.52				19.5	10.35									
Modulus of Elasticity (lbs. per sq. in. x 10^6)		15.0	15.0	15.0	12.8. 15.0	15.0 14.0	15.0	15.0	17.0	26.0	26.0	14.0	19.0. 17.5	—	16.0	—	19.5	—	16.0
Rockwell Hardness ("B"—1/16—100 Kg.)	S	75.1	86.10	88.5	87.42	99.30	86.30		95.30	105.68	85.15	105.65							58. Too soft
	R				87.37						90.8			100.95	85.80	95.90	80	75.70	
	T			93.15	91.24														
Density (lbs. per cu. in.)		0.322. 0.318	0.316. 0.313	0.310. 0.306	0.306. 0.303	0.321. 0.318	0.317	0.316. 0.294	0.316. 0.313	0.318	0.31	0.278	0.297	—	0.32	—	0.3	0.3	0.322
Melting Point (deg. Cent.)		1075. 1045	1090. 1000	980. 930	905	1075. 1025	1040	1055. 1000	1110. 960	1350. 1300	1350. 1315	990	955. 865	1010	1050	1050	1050	1050	1083
Electrical Conductivity (per cent of copper)		66.4 44.9	37.0. 28.1	30.0. 25.85	28.6	43.0. 13.0	13.3	8.5. 5.6	12.0. 5.9	4	3	7.2	34.5. 17.2	55. 45	85. 80	45. 40	80 85	85	100.0
Thermal Conductivity (C. G. S. units)		0.59 0.446	0.38. 0.335	0.31. 0.285	0.300	0.520. 0.150	0.184	0.129 0.066	0.140. 0.080	0.06	0.043	0.092	0.25. 0.18	0.50	0.8	0.403	0.7	0.8	0.9225
CAN BE READILY:																			
Cold Worked		√	√	√	×	√	√	√	√	√	√	×	√	√	√	√	√	√	√
Hot Forged		√	×	×	√	—	√	√	√	√	√	√	√	√	√	√	√	√	√
Cast		√	√	√	√	√	√	√	√	×	×	√	×	√	√	√	√	√	×
Stamped		√	√	√	√	√	√	√	√	√	√	×	×	√	√	√	√	√	√
Machined		×	b	b	b	b	√	√	√	√	√	√	√	√	√	√	√	√	×
Arc Welded		√	√	×	×	√	√	√	√	√	√	√	×	—	√	√	√	√	×
Resistance Welded		√	√	√	×	√	√	√	√	√	×	√	×	√	√	√	√	√	×
Riveted		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Soldered		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Electroplated		√	√	√	√	√	√	√	√	—	—	√	√	√	√	√	√	√	√
IS AVAILABLE IN:																			
Sheets, Strip		√	√	√	√	√	√	√	√	√	√	√	√	√	√	×	√	√	√
Rods		√	√	√	√	√	√	√	√	√	√	√	√	√	√	×	√	√	√
Bars		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√ (Cast)	√	√	√
Tubes		√	√	√	√	√	√	√	√	√	×	×	×	√	√	×	√	√	√
Casting Ingots		√	√	√	√	√	√	√	√	√	×	√	√	√	c	c	×	c	×
Cold Headed Forms		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	×	√
Extruded Shapes		×	√	√	√	×	×	√	×	×	×	×	×	×	×	×	×	√	√
Finished Machine Parts		×	b	b	b	×	√	√	√	√	√	√	√	√	√	√	√	×	×
Hot Pressed Parts		√	√	√	√	×	√	√	√	—	×	√	×	√	√	√	√	×	√
Wire		√	√	√	√	√	√	√	√	√	√	√	√	√	√	×	√	√	√
Brazing & Welding Rods & Wire		√	√	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√	√
IS PARTICULARLY SUITABLE FOR:																			
Resistance to Corrosion		√	√	×	×	√	√	√	√	√	√	√	√	e	√	√	×	—	√
Continued Resistance to High Heat		×	×	×	×	×	×	×	×	√	√	√	√	√	√	√	√	√	×
Continued Resistance to Vibration Fatigue		×	×	×	×	√	√	√	×	√	√	√	√	√	√	×	×	×	√
Continued Resistance to Spark Erosion		×	×	×	×	×	×	×	√	√	√	×	—	√	√	√	√	√	×
Resistance to Wear		×	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	×
Finished Surface Appearance		e	e	e	×	f	f	f	√	√	√	f	f	f	—	—	×	—	e
Screw Machine Parts		×	b	b	b	×	√	√	×	√	×	√	√	√	√	√	√	√	×
Springs		×	×	√	×	√	√	√	√	√	√	×	√	√	√	√	×	—	×
Bearings		×	×	×	×	√	√	√	×	√	√	√	√	×	d	d	d	d	×

Explanation: Because the "Working properties" and "Suitability" of these various alloys are relative and very widely, no unequivocal "yes" (√) or "no" (X) can be given in each case. These designations should be considered as indicative rather than final. **Notes:** a. Particularly to liquid metals. b. With lead. c. Available to licensees only. d. For current carrying bearings. e. Clear lacquer or varnish protective coating desirable. f. Suitable although not ordinarily used for appearance alone.

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PROSPERITY IN THE USA: How Deeply in Debt Are We?

How prosperous *are* the people of the United States? Previous messages in this special series have answered this question in part by recording the progress—relatively slow progress—we have made in increasing both the income and the wealth per person in the USA.

This fourth and concluding piece of the special series deals with the extent to which our prosperity should be discounted because it has been accompanied by an increasing volume of debt. Many correspondents have suggested to us that an individual or a nation can temporarily increase prosperity by borrowing, but in so doing lives on both borrowed goods and borrowed time. Our purpose here is solely to throw light on the question of whether or not we are now in that unenviable position.

On January 1, 1953, the total debt of the United States government and of its citizens was $627 billion, as shown in the table below. On its face, a debt of this magnitude, which represents about $3,900 of debt for each person, suggests that we are heavily debt-ridden.

TOTAL DEBT – PUBLIC AND PRIVATE

Federal government debt	$267 billion
State and local debt	30 "
Private debt	
Corporations	195 "
Individuals	135 "
	$627 billion

The burden of our debts, however, does not depend simply on their size. It depends in much more decisive degree on our capacity to carry the load successfully. This capacity, in turn, is partly a matter of attitude, and attitudes defy objective measurement. A community that gets very jittery about its debts has less capacity to carry its burden successfully than one that does not. But the accurate measurement of jitters, present or prospective, still remains to be mastered.

Capacity to Carry the Debt Load

Nonetheless, it is possible to throw some light on our capacity to carry the debt burden by studying key economic elements that can be measured with some degree of accuracy. The following paragraphs indicate how some of these key economic elements stand.

Compared with our national income, the total volume of our debts, public and private, is still well below the level of 1929, when it proved to be too big for the good of the country. Our total debt is now 113% greater than the national income whereas in 1929 it was 146% greater.

There are several other cheering facts about our debts. One is a sharp decline in interest rates which makes the cost of carrying our debts relatively much less than it was in 1929. It took 8% of our total national income to carry our debts in 1929; it takes only about 5% of the income today.

More Cheering Facts

We also have much more ready cash now than in 1929. Today individuals and corporations hold a total of $269 billion in cash or its equivalent which is almost twice as much as the portion of private short-term debt (about $140 billion) that is subject to sudden demand for payment.

Many students of the subject cite the relatively low cost of carrying our debts and the large volume of cash on hand, and reach the comfortable conclusion that our debt burden is nothing to worry about. In further support of this view they emphasize the fact that no important part of our debt is owed abroad. Hence, they reason there is not the danger, so conspicuous in Britain since the end of World War II, that our economy will be upset by the necessity of making heavy debt payments to other countries.

Some Dangers of Present Debt

However, the nature of our debts presents dangers that it would be foolish to ignore. This is true of both the debt of $267 billion owed by the federal government to its citizens and the $330 billion in private debts owed by some citizens and corporations to others.

Public debt can be a dangerous kind of debt because government has the power to print money or to create its equivalent by expanding bank credit. Of the $215 billion that the federal government borrowed during World War II, over $90 billion was borrowed from banks. This was the largest single contributor to the inflation of prices that since the war has robbed the dollar of about half of its purchasing power, and thereby robbed the buyers of government bonds of about half the purchasing power these bonds were supposed to represent.

If, as is quite possible, a new emergency should again require the federal government to borrow heavily while its debt remains so high, it is doubtful that the public would be avid to buy its bonds. Hence, the government might again be forced to resort to the inflationary process of relying on bank credit.

Private debts can be dangerous if the people take on new debts more rapidly than is justified by the growth of business or by their ability to repay. Last year bank loans were increased by the imposing sum of about $6½ billion, which represents an increase of about 11% in total loans outstanding. This is almost twice as much as the increase in the volume of business over the same period. Installment credit for consumers increased by $3 billion last year, again an increase in debt about twice as great as the increase in business volume in the fields where the credit was used. It is also the fastest rate of such growth in our history.

Constructive Use of Credit

So long as the expansion of credit does no more than keep pace with expansion in the volume of business, the expansion is constructive. Also, when credit is expanded to acquire resources and equipment that will enlarge the volume of business a little later, that use is clearly constructive. But when private credit expansion begins to run ahead of business growth, it is time for us to be heads up. Such credit expansion courts price inflation. It also creates a forced draft under business so that, if credit is cut off, there may be a painful drop.

To give a summary answer to the question: *Is the level of debt in the United States a danger to our prosperity?* — the answer seems to be, "Not at the moment." We owe nothing abroad. The interest burden on present debt is relatively small, and we appear to have the resources to handle the short-term debt. Yet both the total amount of debt and the recent rapid increase in total private debt, especially the latter, are enough to signal for caution. We need restraint on the part of business and consumers to avoid expanding private borrowing at an excessive rate. The federal debt needs to be reduced and put in more manageable form. If these things are done, we can proceed to build a sound prosperity.

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TWO WELDORS fabricate beams as they're needed for 500 houses. The steel was bought in standard lengths

POINT of this picture is the tote box at the left. It is raised to work level by an air-hydraulic lift

Welding Speeds Housing

THE 500 houses in the San Fernando Hills project of the Charles Vatterott Co., St. Louis, needed a large quantity of steel I-beams of varied sizes. Most of the houses are small—some brick and some frame with asbestos shingles. The steel support for the small basements is a simple beam and column.

Fabrication of the beams was greatly speeded by putting a crew of two contract weldors on the job. The weldors and their machines were furnished by the Rock Hill Welding Co., St. Louis. As soon as the concrete had been poured for a house foundation, a weldor fabricated the beams to fit. The steel was bought in standard lengths and dumped on the lot along with lumber, brick and other materials. The weldors added pieces to make up the required length of each beam or joined together the short ends left over to make new beams.

The columns were cut and placed at each foundation. Another welding crew came along at the proper time to set the steel and weld the column to the beam and base plates.

* * *

How to Make Screen Guards

By W. F. Schaphorst

FOR the sake of safety, it is a commendable practice to place guards around "dangerous" machinery such as motors, belts, gears, chains, etc. In many places, guards of metal are required by law. Guards made of high-grade wire screen have these advantages:

1. They are more transparent than other guards, so the details of the guarded machine can be seen without difficulty.

2. Wire guards do not hinder nor deflect air currents. This is important in the case of electric motors that are likely to heat where ventilation is poor.

3. Wire guards can be made strong enough for any guarding purpose.

4. They are light in weight and hence can be removed and handled without difficulty.

5. They are easily made. Wire screen can be bent to almost any desired shape. For some enclosures, a single joint often suffices.

6. Stiff wire screen is self-supporting and seldom requires intricate framework.

An easy way to make wire guards for almost any purpose is to make the framework out of steel angles and the sides out of wire screen of suitable mesh.

First make the frame. Angles are not easily bent without cutting out portions of the flange. You must cut out some V's from the inner flange where the bend is to be made. If the bend is to be 90 deg, cut out a square V. If the bend is to be 45 deg, cut out a 45-deg V, and so on. In other words, cut out a V of an angle equal to the bend wanted.

After the frame has been formed, put in the wire screen or wire cloth. The quickest way to fasten the wire in place is via the welding torch. The same torch, of course, may be employed for welding the frame together before you proceed with the wire.

* * *

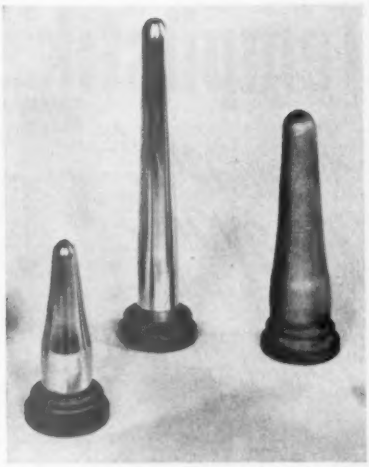
Up Goes the Box!

LIFTING up workpieces from the floor to a spot welder can be an expensive production operation as well as a back breaker to the man doing it. A better way was found by Geerpres Wringer, Inc., of Muskegon, Mich. Geerpres has a new 19,200 sq ft plant devoted entirely to the production of mop wringers and allied floor-cleaning equipment.

The new way is to use an air-hydraulic lift at the spot welder. The lifting device, shown at the left of the righ-hand picture, is raising a tote box of perforated stampings from its separate castered base to the workbench level. Other stampings have been previously unloaded for spot welding; the particular operation is to spot weld a shaft inserted through the bead of the stamping.

The air-hydraulic lift has a capacity of 1,000 lb and can work much faster than human beings in raising the work to the welder loading bench.

Another interesting application of resistance welding in the new Geerpres plant is to temper a mop stick regulator spring. A spot welder is used to relieve stresses in the spring that were produced during a previous forming operation.



Courtesy Wall Colmonoy Corp.

Longer Lived Glass Plungers

IF YOU WANT to make a glass bottle, you begin by dipping a metal plunger into molten glass and carrying on from there. It is now done by a molding machine. Cast iron was the material traditionally employed for glass plungers because of its ability to withstand heat, but better plungers are now being made from mild steel.

By protecting the surface from heat and wear with a sprayed-on coating of hard-facing alloy, steel plungers are being made that function up to 54 times longer than the cast-iron variety. The heat-resistant alloy is applied by a powder metal-spraying process.

The equipment required to do the job consists of a "pistol," a hopper for the alloy powder, a carburetor, an air regulator, an air filter and suitable hoses. A lathe and grit-blasting equipment are also necessary. In the first step, the plunger surface is undercut to the depth specified for the overlay. Then the surface is blasted with steel grit to provide a good mechanical bond between the base metal and the sprayed-on alloy.

After a smooth overlay of alloy has been built up to the required thickness, it is fused to the base metal. This is done by rotating the plunger, in the same lathe used for metal spraying, under an oxyacetylene flame. The alloy is thus molecularly bonded to the base metal in a nonporous deposit. The plungers are finish machined with a carbide tool before installation in the molding machine. The accompanying picture shows two plungers that have been machined and one (on the right) in the unfinished condition. Machining can be held to a minimum as the overlay can be deposited within 0.020 in. of finish dimensions.

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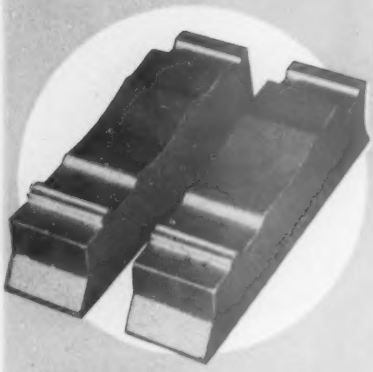

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BOOK REVIEWS

Non-Ferrous Metallurgy

NON-FERROUS PHYSICAL METALLURGY, By Robert J. Raudebaugh. Published by Pitman Publishing Corp., New York, 1952. Cloth 6 by 9 in.; 345 pages. Price $9.

Here are completely treated such metals as aluminum, magnesium, copper, nickel, cadmium, lead, tin, zinc and some of the scarcer nonferrous materials, beryllium, cobalt, molybdenum, etc. The same program is followed in discussing each metal: first, a discussion of the commercial grade, then the mechanical properties, melting, practice, casting technique, working characteristics, fabrication, heat treating, machining, cleaning and finishing. Each chapter closes with a bibliography of the pertinent references dealing with the specific metal.

Purpose of this book is to review the more important nonferrous metals from the physical metallurgy aspect. Particular emphasis is placed on recent development in processing, fabrication and applications of these materials. Welding is touched on lightly in those chapters about aluminum, copper, magnesium and nickel alloys. The closing chapter presents a rather extensive treatment of powder metallurgy and refractory metal composites.

* * *

Engineering Materials

TEXTBOOK OF ENGINEERING MATERIALS. By Melvin Nord. Published by John Wiley and Sons, Inc., New York, 1952. Cloth, 6 by 9 in.; 518 pages. Price $6.50.

As the name indicates, this volume was written primarily as a textbook for engineering students of sophomore level or lower. It presents the subject of engineering materials in a comprehensive and fundamental manner, different from the handbook style.

Essentially, the book is divided into two parts. The first half of the materials deals with the subject quite generally. It opens at an elementary level, introducing fundamental concepts of physics, chemistry, geology and other basic subjects and includes practical problems in each of these various branches of science. To give the student a good background on raw materials, they are traced from mine to finished product.

Second half of the book shows the reader how basic engineering concepts are applied to problems of occurrence, production, properties and

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the uses of various engineering materials. A simple treatment is given on economic factors in engineering practice. Discussing engineering materials specifically, there are covered such diversified subjects as water, fuels, explosives, ferrous metals, nonferrous metals, building stones, simple cementing materials, complex cements, clay, glass, rubber and plastics. Welding is reviewed briefly with a major part of the space devoted to resistance welding processes.

This volume will serve as a handy reference on engineering materials for students and engineers in practice.

* * *

Elastic Problems

ELASTICITY IN ENGINEERING. By Ernest E. Sechler. Published by John Wiley and Sons, Inc. New York, 1952. Cloth, 6 by 9 in.; 419 pages. Price $8.50.

Here is a book for engineers working in the structural analysis field, particularly aircraft engineering. It is believed however, that the information here will be found almost as useful for civil and mechanical engineers. It is the aim of the author to develop a text that will fill the gap between theories of strength of materials and those of elasticity. Therefore, in this single volume will be found the broad background of knowledge based on the fundamentals of stressing theory and those on the deformation of elastic bodies under load.

The book is in three sections of 15 chapters, all loaded with highly complicated mathematics. The first part establishes the equations and assumptions underlying the field of elasticity and collects the basic formulas useful for solving elastic problems. Once these basic equations have been derived the solution of almost any structural problem can be obtained either by rigorous use of them or with approximate methods based on them.

Problems in non-buckling structures are taken up in the second part of the book. The third section deals with buckling structures. Both sections discuss approximate methods for solving problems too complex for formal proof. A number of examples are given and many class problems. Most of the problems chosen serve a two-fold purpose: to be practical insofar as possible and to illustrate the fundamental principles of the situation being studied.

* * *

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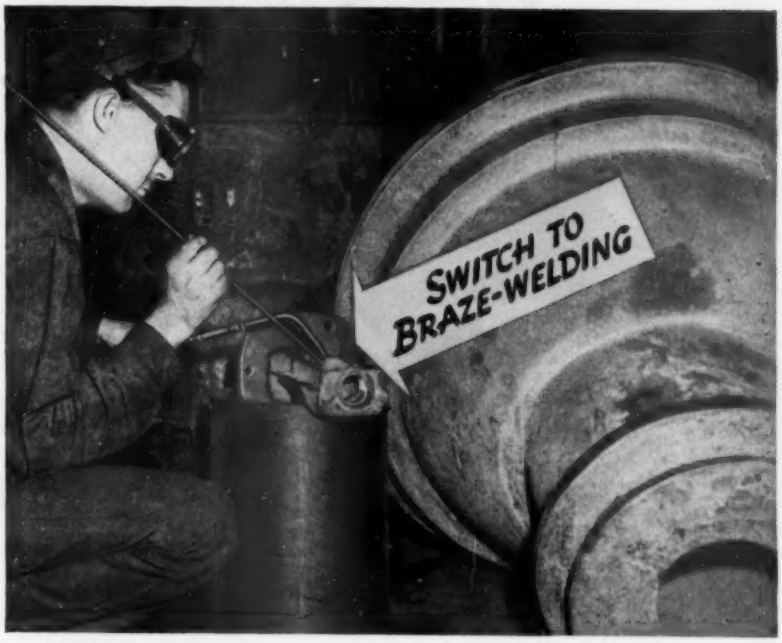

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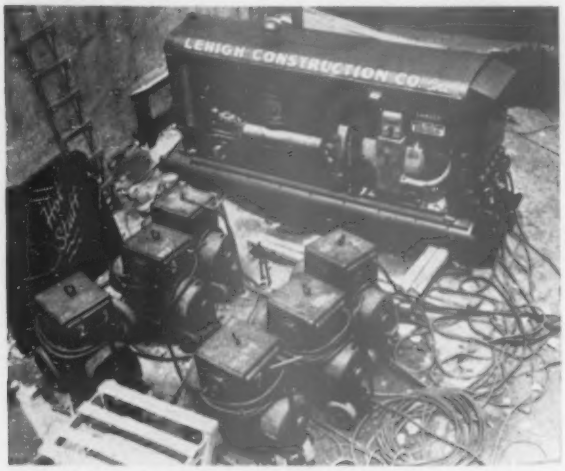

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In the picture shown above, the specially-built skids under the generators serve doubly as fuel tanks.

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* * *

Silver Brazing Flux

252 AN improved, all-purpose version of its "1200" silver brazing flux has been developed by The American Platinum Works. It can be used on all metals at all heats common to silver brazing, says the company. It consists of a mixture of fluoride and borate salts and melts at a temperature lower than the silver alloys involved. It prevents oxidation and cleans off dirt and oxide.

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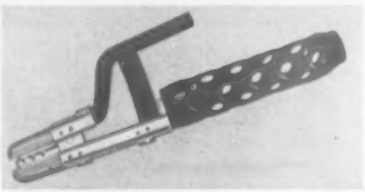


400 Amp Insulated Holder

253 HEAVY perforations in the handle and a special jaw construction keep the "Cooltong" 400-amp holder running cool. The nose is a special sandwich consisting of a copper core between four and six layers of laminated, glass impregnated, plastic cloth. The copper core is not only a reinforcement but also dissipates heat.

Electrode jaws, covered by the special insulating construction, are made of Mallory 3 metal, non-spatter type. They will handle electrodes from 1/8 to 5/16-in. in size. Current-carrying frame parts are made of pure copper for high conductivity. These parts are reinforced with steel to increase rigidity and strength of the frame. The framed insulation is covered with a copper sheathing to protect the insulating part from heat and spatter.

Handle of the holder has very large holes to increase ventilation and reduce heating from induced currents.

THE LINCOLN ELECTRIC CO., 22801 St. Clair, Cleveland 1.

INFO-AID CARDS

on pages 33-34 filled out with item numbers of products catching your eye, will bring you additional information about them.

Welder Timer Analyzer

254 A NEW electronic tube analyzer gives a comprehensive check on thryatron control tubes in resistance welder timer circuits. This small 4 by 4 by 6 in. instrument checks on the filament continuity, cathode emission, control grid characteristics and shield control characteristics. It also indicates excessive arc drops within the tube and internal shorts.

The checker incorporates a potentiometer knob with a self-explanatory indicating dial and a neon indicating lamp to simulate actual operating conditions of welder timers. The device give a quick analysis on thyratron tubes 2050, 502A, 2D21 and 2051.

ROBOTRON CORP., 21300 West Eight Mile Road, Detroit 19.

* * *

Versatile Hard-Facing

255 GOOD resistance to abrasion at high heat, ability to withstand attack by molten copper and improved welding characteristics are claimed for CM-199, a new hard-facing alloy. Because of the first listed quality, it has found application as hard-facing for large guide rolls, hot friction guides and tong bits in hot-rolling mills. Its resistance to molten copper makes it useful on the lips of copper converters. It can be welded over itself to permit patching, where heretofore full replacement of the coating had been necessary.

COAST METALS, INC., Little Ferry, N. J.

300 Amp A-C Welder

256 A REDESIGNED 300-amp a-c welding transformer features stepless current selection from 40 to 375 amp. New points are an enlarged scale and finely threaded screw adjustment to facilitate easy current selection. It takes electrodes from 3/32 to 1/4 in. and has a handy range switch enabling the operator to change quickly from high to low or low to high range.

Arc-stabilizing capacitors in the new weldor are said to provide a stable arc. Extra high-temperature protection for the coil is provided by silicone insulation.

Studs are built in at the base to simplify connecting electrode and work cables. Power-factor-correction capacitors assure economic operation. Measurements are 31-in. high and 21-in. in diameter. Weight is 328 lb.

GENERAL ELECTRIC CO., Schenectady 5, N. Y.

* * *

Pre-Weld Cleaner

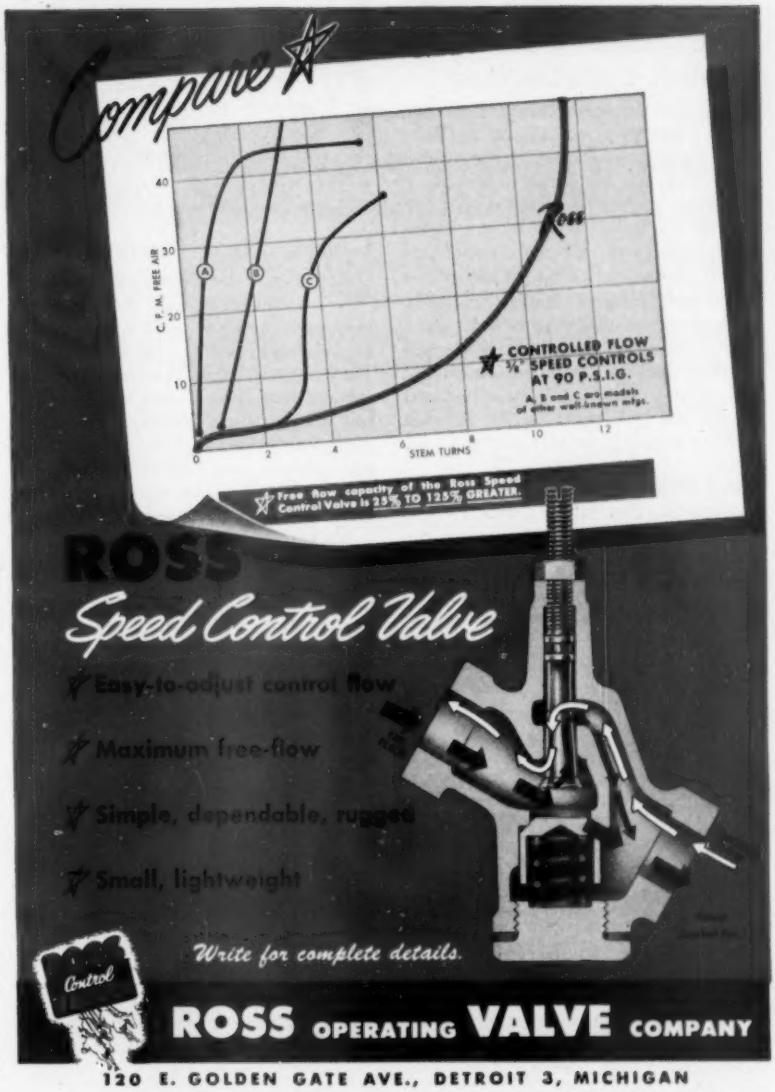
257 EXCEPTIONALLY clean aluminum surfaces for high-quality spot welding are claimed with the use of the "Alkalume" cleaning process. Surface resistance is reduced to between 0 and 10 microhms. A continuous resistance of only 10 to 20 microhms will persist on the sheet for many days without reoxidation, claims the company.

Equipment needed includes a conventional steel tank, a stainless or Koroseal-lined tank and a synthetic-organic or Koroseal lined tank (stainless tank and stainless heat exchanger is preferred, however).

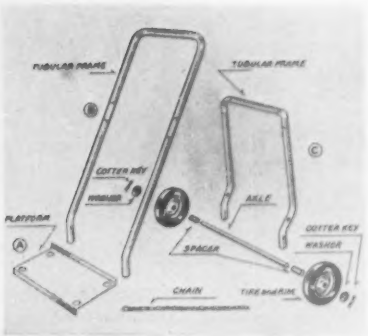
Laboratory tests on various alloys and gages of aluminum show that the "Alkalume" process prepares the way for welds of high shear strength with less tip cleaning needed and lower forging pressures. Cleaning results are said to be uniform.

NORTHWEST CHEMICAL CO., 9310 Roselawn, Detroit 4.

IF IT'S A VALVE FOR WELDING— ROSS HAS IT



Engineers at Your Service in all Principal Cities



Pre-Fab Cylinder Cart

258 KITS for putting together sturdy, good-looking cylinder carts are now available. A distributor can either sell the kit or assemble it himself to sell at a greater profit.

Only six braze welds or arc welds are necessary to join the components shown above. Packaged kit includes a 1-in. steel tubular frame, 11 gage steel platform and ½-in. steel axle, 8 by 1.75 wheels equipped with ball bearings and rubber tires. Completed cart is 19-in. wide, 9½-in. deep and 41 in. high. Weight is 24 lb. Kit comes packed in a 5 by 18 by 44 in. carton.

R & R WELDING SUPPLY CO., 315 Twelfth St., Des Moines, Ia.

* * *

Universal Flame-Cutter

259 A WIDE range of jobs can be handled by the Vernon "Universal" flame cutter, the company reports. It will cut ells to any angle, shorten ells, tees, flanges, reducers and will re-cut and bevel used ells, tees, swedges and returns. Additional uses are cutting small miters-22½-deg or less, cutting holes in blanks for slip-on reducing flanges, making swedges out of welding caps and cutting and beveling short pieces of pipe up to 36-in. in diameter.

The flame cutter is mounted on a sturdy base with a simplified control panel and gas control valve. The work-holding table revolves in either direction at speeds up to 5 rpm.

VERNON TOOL CO., LTD., 1101 S. Meridian Ave., Alhambra, Calif.

* * *

Goggle Heat Protectors

260 FOR jobs where extreme heat is experienced, AO has developed a new series of eye binders, bridges and bindings for side shields. They are non-toxic, heat-resistant and perspiration proof and are said to last longer than leather. They are permanently stitched on eye binders and bridges and heat-sealed on side shields. They can be washed or sterilized as often as necessary.

AMERICAN OPTICAL CO., Southbridge, Mass.

* * *

Sand Blasting Nozzle

261 OUTSTANDING feature on a new sand blaster is the venturi profile on its blasting nozzle. It is said to speed sand blasting of scale, rust and paint as much as 25% over other machines.

Higher blasting efficiency of the "Belmont" sand blaster nozzle is said to be due to the elimination of "throat choking" and muzzle turbulence that ordinarily dissipate the force of abrasive action. The nozzles are made of tungsten carbide for long life.

The Belmont sand blaster itself is a portable outfit that comes in three sizes ranging from 125 to 1,000 lb. sand capacity.

VACU-BLAST CO., 670 Peninsular Ave., San Mateo, Calif.

* * *

Air-Cooled Ignitron

263 A NEW 56-ampere ignitron does not require water cooling. Designated NL-1005 it is designed for forced-air cooling, but may be used at reduced ratings with free ventilation. Elimination of water cooling is expected to permit use of the tube where such application hadn't been practical.

For welding controls, the NL-1005 is the approximate equivalent of a 300 amp magnetic contactor. It is electrically similar to the 5551 Size B ignitron tube. The NL-1005 is capable of controlling maximum rms demand current of 2,400 amp at 250 volts a-c or 1,200 amp at 50 volts a-c. Maximum average anode current rating is 56 amp d-c.

NATIONAL ELECTRONICS, INC., Geneva, Ill.

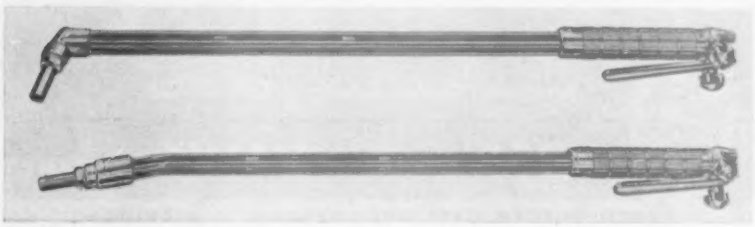
* * *

Magnetic Pipe Plugs

264 MAGNETIC pipe, drain and filler plugs for attracting ferrous particles from the liquid stream are once again available. They range in size from ⅛ to 2 in., inclusive and are made to original equipment standards in the following styles: square heads, square counter-sunk, hex countersunk, slotted, hex head and specials, in such metals as cast iron, steel, malleable iron, brass, aluminum and stainless.

MAGNETIC DRAIN PLUG CO., Wellington, O.

(More New Products on page 93)



20 and 75-Deg Heads for Flame-Washing Torch

262 A NEW oxyacetylene "flame-washing" torch was specially built to remove riser pads from castings. A unique tip is said to produce a clean, washing action rather than a grooving, or cutting mark so that the casting needs no further finishing. It is available with 20- or 75-deg heads and with two sizes of tips for various types of metal removal.

For stainless and high alloy steel castings, a special powder-cutting version of the torch may be purchased. It can be used with any type of powder-dispensing equipment. Other useful jobs around a foundry include removal of chill bars and shallow cracks. Savings are said to be substantial over chipping and grinding clean-up methods.

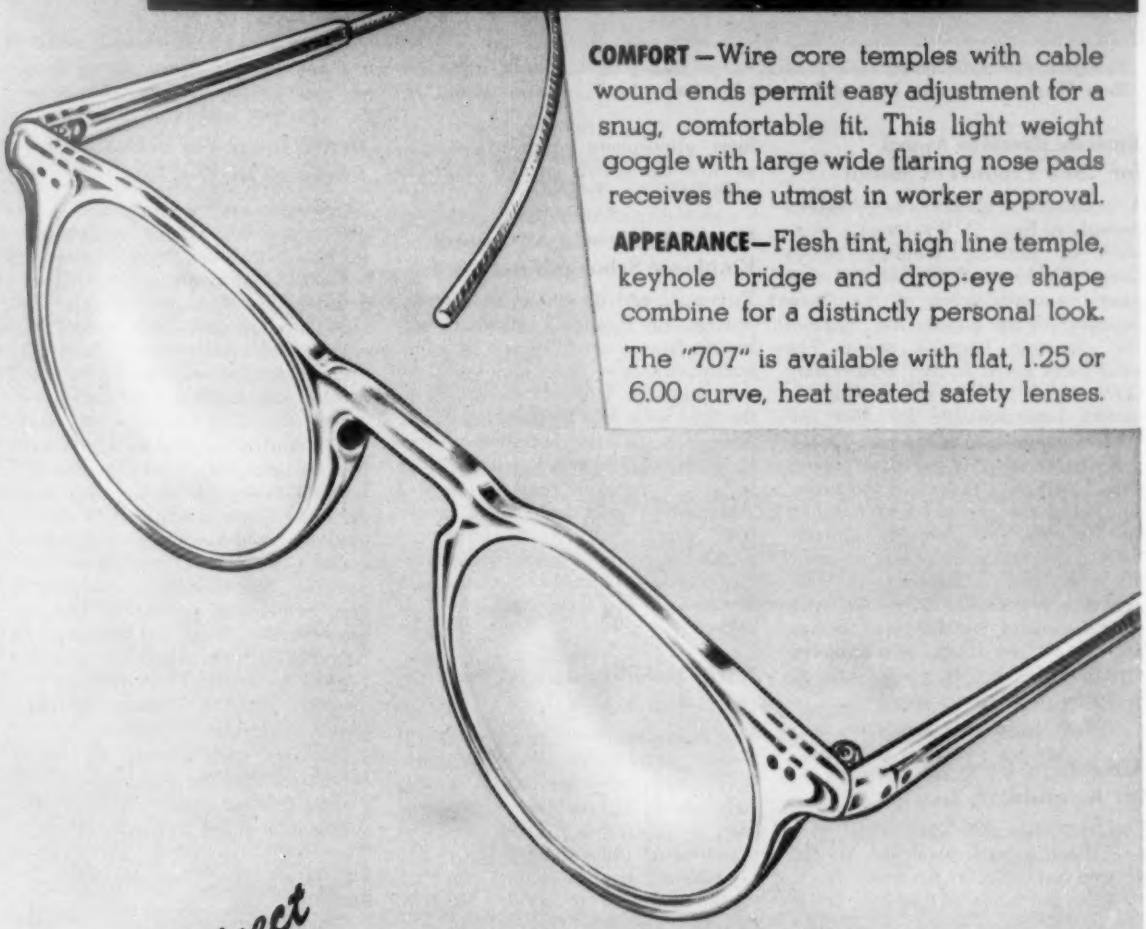
NATIONAL CYLINDER GAS CO., 840 N. Michigan Ave., Chicago 11.

The new plastic "707" Safety Goggle combines

Protection — Comfort — Appearance

PROTECTION — is still the basic purpose of this new style goggle. Its acetate frame has been designed to retain the safety lens even when subjected to severe impact. In addition to its general use throughout industry where eye hazards are encountered, the non-sparking "707" is especially suitable for use in chemical and electrical plants.

MODEL 707 PLASTIC FRAME SPECTACLE TYPE SAFETY GOGGLE



COMFORT — Wire core temples with cable wound ends permit easy adjustment for a snug, comfortable fit. This light weight goggle with large wide flaring nose pads receives the utmost in worker approval.

APPEARANCE — Flesh tint, high line temple, keyhole bridge and drop-eye shape combine for a distinctly personal look.

The "707" is available with flat, 1.25 or 6.00 curve, heat treated safety lenses.

Order Direct and Save!

PENNSYLVANIA OPTICAL COMPANY

READING, PENNSYLVANIA

Known for Fine Ophthalmic Products Since 1886

NEWS

from page 6

PLAQUE for outstanding new product is presented to Rene Wasserman, right, head of Eutectic Welding Alloys

WELDING JIG holds side pieces to book-pan of desk-arm chair. Inert-gas spot welding makes 25 joints

Eutectic Receives Award for "New Product of Month"

A DECORATIVE plaque was presented recently to Rene D. Wasserman, president of Eutectic Welding Alloys Corp., Flushing, N. Y. for his company's announcement of the "new product" of the month, the "Chemo-Tec" organic bonding agent. The award was given to Mr. Wasserman, above right, by Richard A. Gagney, eastern representative for *Mill and Factory* magazine, above left.

Each month the editorial board and engineering judges of the magazine select the product they consider has made the most valuable contribution to industry. The Eutectic product was selected out of some 250 products reviewed. "ChemoTec" will join dissimilar metals, glass, ceramics, rubber, etc. from room temperature up to 500 F with a bond strength in excess of many solders.

* * *

Airco Liquid Oxygen Plant for Riverton, N. J.

CONSTRUCTION will soon begin on a new liquid oxygen plant for Air Reduction Sales Co. at Riverton, N. J., 10 miles northeast of Camden. Set to deliver oxygen next year, the plant will serve the Delaware River Basin primarily, but will supplement other Airco plants providing service north to New England and south to the Carolinas.

About 100 people will be employed at the plant which will represent an investment of several million dollars.

Besides oxygen, the plant will produce nitrogen and argon, for various inert atmosphere applications such as fire extinguishing and inert-gas welding.

* * *

Handy & Harman Announces Employee Scholarship Awards

THE sons and daughters of the employees of Handy & Harman will benefit from a new program of scholarship awards recently announced by the company. The 900 employees of the firm were told by president G. H. Niemeyer that the applications had to be made by March 1, with winners to be announced in June. Winners of scholarships may keep them up to four years, with a maximum of $1,000 a year for each individual. The applicants could select any field of study at any accredited school or college.

* * *

North Carolina Boiler Plant for Babcock & Wilcox

ERECTION plans for a new $2,000,000 boiler plant south of Wilmington, N. C., have been completed by The Babcock & Wilcox Co. A 153-acre tract was purchased with construction to start immediately.

This will be the second plant of the company to be located at Wilmington, and the fifth new plant to be added to the company's boiler division in a little over a year. This makes a total of seven. In making the announcement, C. H. Gay, vice-president, said that the new plant would mean that the company had more than doubled its productive capacity in the boiler division.

The new plant will employ about 750 men when its operations start about the middle of June.

Better Desks For Schools Produced by Welding

SUBMERGED-arc welding and inert-gas spot welding have boosted production of desks and chairs for school kids made by the Arlington Seating Co., Arlington Heights, Ill. One popular desk-chair model features a bowl-shaped swivel assembly upon which the seat can be mounted to permit a limited rotational movement.

The bowl-shaped assembly is held by an automatic positioning and holding set-up. A turning jig locks the bowl-shape in place while an air-operated hold-down clamp presses a round plate 6¾-in. in diameter into position. Submerged arc welding is done while the jig turns. Welding time for the 21 in. circumference is only six seconds using 385 amp d-c reverse polarity. This welding was formerly done by manual arc and coated electrodes.

Inert-gas spot welding is largely responsible for the unique design of a movable class room chair having an enlarged arm for a writing surface. An ingenious holding and positioning fixture (photo above) aids the process.

This fixture clamps both 16-gage chair sides to the 20-gage single piece book pan, to form the entire lower half of the chair. A welding operator revolves the fixture and makes 25 spot welds at various points. Rate of production is said to be tripled over the older method. Argon gas is consumed at the rate of 10 liters per minute. Welding current is 300 amp, a-c, according to word from Linde Air Products Co.

Rocket Welding Papers at Western Metal Show

TWELVE intensive technical sessions on every type of welding have been planned for the Western Metal Show, March 23-27 in Los Angeles. Programming is in charge of the Los Angeles section of the American Welding Society. W. H. Skewis is program chairman. Technical meetings will be in the new Statler Hotel.

Welding sessions for the first day, March 23, will cover the following topics: distortion control, economical design, jigs and fixtures, arc welding of low chrome-moly steels, inert-gas welding of pipe, causes and corrections of micro-cracking, electrode coatings for mild and stainless steels, welding controls and non-destructive testing.

On the following days these subjects will be discussed: submerged arc welding; inert-gas welding; aircraft and rocket component welding; structural welding; relation of technique to penetration and dilution; shielding gas mixtures for inert-gas welding; automatic welding of copper; silicon bronze; aluminum bronze and carbon steels; high-strength joints in low alloy steel; manual and automatic welding of aluminum and welding of high-strength aluminum castings, aircraft flash welding; pressure-welding tooling; comparison of applications and specifications. Titanium and stainless fusion welding in the fabrication of rockets and airplanes will be discussed also. A session on spot and projection welding has listed papers on military specifications, welding techniques and quality control.

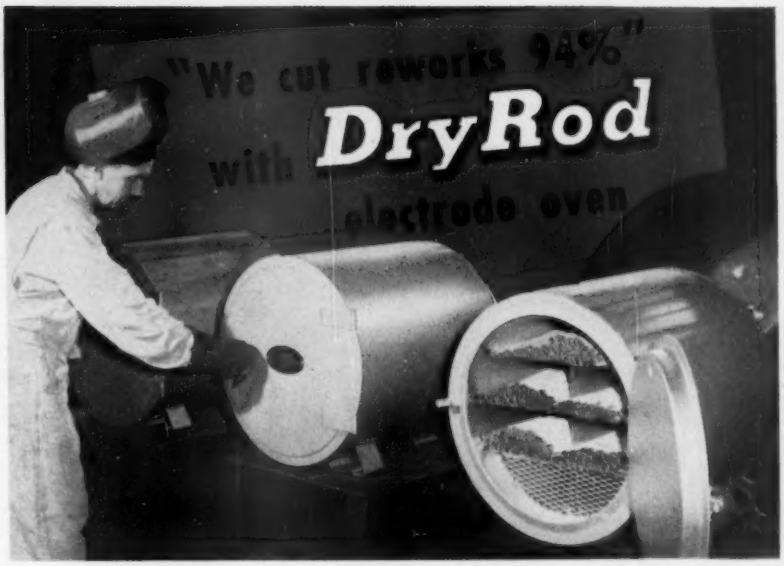
Vacuum brazing of clad steels, titanium brazing and controlled atmosphere brazing will be the subjects of talks. Gas and powder cutting of carbon and stainless steels and hard-facing techniques will also be covered. Last papers of the program will be on research and new developments in arc, inert-gas and pressure welding.

Admission to all sessions of the Metal Congress will be free to industrial visitors. Those holding membership cards in the AWS and other cooperating societies may walk right into the exposition in the Pan-Pacific auditorium.

* * *

Palladium Aids Brazing

NEW brazing alloys for joining Nimonic and other high-heat alloys used in jet engines contain palladium, one of the precious platinum group metals. According to The International Nickel Co., these alloys are in use in England.



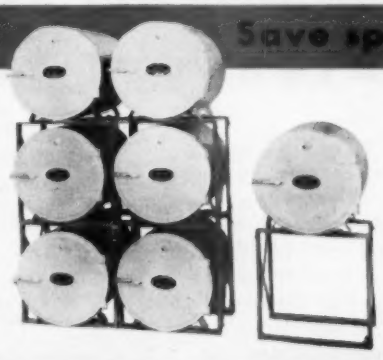
When rejects reached 1 in 3 on a welded hydraulic fitting, engineers of a leading Milwaukee machinery plant* diagnosed the trouble as moist electrodes. They installed a low-cost DryRod Electrode Oven . . . stored all unpackaged low-hydrogen rods in it. Welders noticed *immediate* improvement . . . got faster, better welds, with few rejects. As the welding engineer put it, *"DryRod successfully solved our welding porosity problem. With it we've been able to cut our reworks from 30 pieces to less than 2 pieces per hundred. That's a 94% reduction."*

*Name on request.

Get your money's worth

You pay a premium for stainless steel, low-hydrogen or other mineral-coated electrodes. Preserve that "baked-in" quality with DryRod Electrode Oven. Three 350-lb. capacity ovens occupy only 5 sq. ft. floor space with new DryRod stand. 175° to 550° range, 110/220 or 220/440 volt AC. See your welding supply dealer, or write direct for free folder.

DryRod—Trademark X-DR-9



DryRod's new sectional stand gives compact, convenient volume storage of various types and sizes of rods at low cost. Units are easily added, moved, or removed at any time. 3-deep bank is 24" wide, 29½" long, 5'11" high.

DryRod

Electrode Oven

DIVISION OF
Phoenix Products Company
MILWAUKEE 16, WISCONSIN

WRITE FOR FULL INFORMATION

Phoenix Products Company X-DR-9
4715 N. 27th St., Milwaukee 16, Wis.

☐ Send bulletin DR-752 showing how DryRod can save me money on high-strength welds.

☐ Send chart giving recommended temperatures for various mineral-coated electrodes.

Name .....
Company .....
Address .....
City ..... State .....

Weld "difficult" steels with little or no pre-heat!

use P&H LOW-HYDROGEN ELECTRODES

P&H has the industry's most complete line of low-hydrogen electrodes — many custom-built to match the chemical analysis or heat-treating properties of a variety of alloy steels. Being hydrogen-free, these electrodes eliminate underbead cracking — little or no pre-heat is needed to get high-strength welds on problem steels, steel castings, nickel-alloy steels, chrome-moly steels, .40 carbon castings, high-hardenable steels, aircraft and similar steels. There are other important advantages, too — for example, lower cost, compared to stainless-steel electrodes formerly used on many jobs. Ask your P&H representative or distributor for all the facts. Or write for bulletin 5-26.

P&H WELDING DIVISION
HARNISCHFEGER CORPORATION
4513 W. National Ave. • Milwaukee 46, Wisconsin

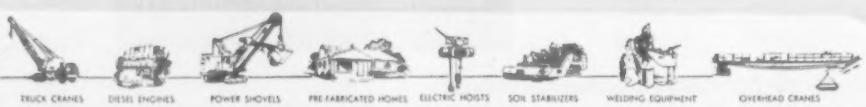
Chrome-moly header, typical of high-pressure, high-temperature applications.

Low-alloy casting, typical of applications where physical properties must be matched.

Alloy gear rim, typical application matching heat-treating properties of parent metal.

Excavator body, typical of heavy sections welded with P&H Low-Hydrogen Electrodes.

the P&H Line



2495

NCG-Pacific Coast Moves To New Building

WAREHOUSING and office space of National Cylinder Gas Company-Pacific Coast are now consolidated in a brand-new building on Pacific Blvd. in Los Angeles. This subsidiary of National Cylinder Gas Co. produces oxygen, acetylene, hydrogen and nitrogen at nearby Compton. These products plus carbon dioxide and dry ice will be handled through the new building's 12,000 sq ft of warehouse space and 7,500 ft of office area. The new site will be headquarters for both the L. A. district and the Pacific division sales offices.

The parent firm of NCG operates 75 gas manufacturing plants in this country and has others in Canada, Venezuela and Colombia. C. J. Haines, president, says that the company's line of medical equipment, including hospital piping systems and inhalation therapy equipment is expanding rapidly. During the last two years NCG piping systems have been installed in more than 400 hospitals. Newer hospitals and other large users of therapy oxygen receive deliveries by tube trailer.

* * *

Welding Exhibit Stars at California Polytech

AGRICULTURAL, engineering and liberal arts exhibits will be displayed at the 1953 Poly Royal show at California State Polytechnic college, San Luis Obispo, on April 24-25. Twenty-eight major departments of the school will participate in the famous "Country Fair on a College Campus." Other events include dances, sports events, a radio show, a carnival, a western barbecue and a rodeo.

Reigning over the festivities will be Miss Cecilia Fava, shown above in front of an inert-gas welder. She is a Sacramento State College coed, chosen by the all-male student body of Cal Poly.

Photo courtesy Remington Rand Inc.

Cadwelding Sales Boosted by Loose-Leaf Binder

PRINTING and correction expenses for up-dating the Caddy Arc Welding Accessories catalog were becoming a headache to Erico Products, Inc., several years ago. An intensive sales and promotion program in the late 40's on the "Cadwelding" process for welding cable and holder connections, had resulted in a big growth in business. It was important to find a catalog that would adequately describe and display the company line as more products were added, and it seemed wasteful to reprint the entire book every year.

Solution found, says Allan H. Siebert, Erico advertising manager, was an easy-to-handle loose-leaf binder to which new application sheets could easily be added. Seen at left above, it is a four-ring, hard cover, black imitation levant grain leather binder. Cover and backbone carry the company insignia and the trademark of the Cadweld process.

The entire job, including the embossing, was done by the supplier of the binders, which saved Erico the trouble and expense of taking the catalog through the two processes. Even the die-making for the embossing job was taken off Erico's hands.

The catalog is divided into four separate sections: electrical connections, signal bonds, arc welding accessories and cathodic protection. For field work, where only one section is needed, the distributor or customer is provided with a lighter cover, seen at above right. It is embossed with the same design.

Each section carries pictures of the parts, a description and instructions for each application. The heavy binder usually outlasts two or three complete changes of catalog sheets.

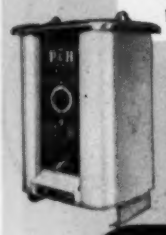
Reports from Erico customers indicate the changeover from a bound book has been successful. The binder is easy for them to handle and to keep up to date. Presence of the Erico name on the backbone has made location of the catalog easier, since such material is usually kept in a standing position on a bookshelf.

P&H

WELDING HEADQUARTERS

—that's where you find cost-cutting answers to welding problems

P&H AC WELDER



Any heat at your fingertips — right at the work — with Dial-lectric Instantaneous Remote Control. Sizes up to 625 amps., NEMA rated. Connectable to 220 and 440 volts.

P&H WELDING TWINS

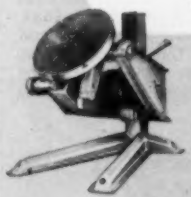
P&H DC RECTIFIER WELDER

Right now —at the work — fingertip Dial-lectric Control gives you the heat you need. Three sizes, 200,. 300, and 500 amps., NEMA rated.

P&H WN-301 *Engine-Driven* DC ARC WELDER

It's portable—weld anywhere, anytime. Dial-lectric Control gives you fingertip heat control at the work — for faster, better welding. Runs at only 1750 rpm. Welding service range, 60-375 amps., NEMA rated.

P&H POSITIONERS



One finger is enough to position heavy weldments for economical downhand welding. Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.

Ask your P&H representative or distributor for complete information, or write for free bulletins.

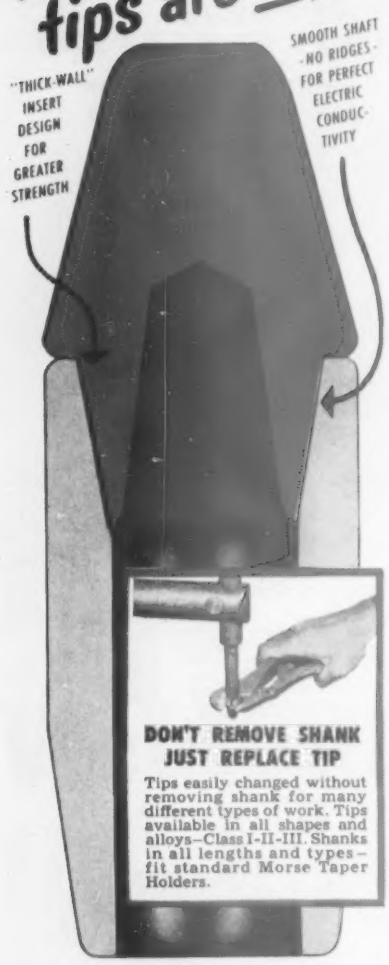
P&H WELDING DIVISION

HARNISCHFEGER CORPORATION

4513 West National Ave., Milwaukee 46, Wis.

2495A

Pacific REPLACEABLE tips are tops!


"THICK-WALL" INSERT DESIGN FOR GREATER STRENGTH
SMOOTH SHAFT -NO RIDGES- FOR PERFECT ELECTRIC CONDUCTIVITY
DON'T REMOVE SHANK JUST REPLACE TIP
Tips easily changed without removing shank for many different types of work. Tips available in all shapes and alloys—Class I-II-III. Shanks in all lengths and types—fit standard Morse Taper Holders.

fully water-cooled . . .
original and best — Pat. 2,440,463

PACIFIC TIPS are the famous *replaceable* spot weld tips that are *irreplaceable! Accept no substitutes!* For finest performance at lowest cost be sure you get PACIFIC. Users report savings up to 50%. Scientific design fully protected by patent. Saves machine down time, wear and inventory costs. Use in machines, portable guns . . . in straight or offset holders. Get complete information and prices today.

Pacific

Distributors in Principal Cities

Smith Bros. & Hughes

5304 Banks St., San Diego 10, Calif.

Manufacturers—resistance welding electrodes and accessories, automatic screw machine products

Inquire for Distributor and Dealerships

Magnesium Exposition Spotlights Its Wide Usage

HUNDREDS of present-day uses for magnesium will be displayed at the International Magnesium Exposition, March 31, April 1-2, at the National Guard Armory in Washington, D. C. Exhibits will include Armed Forces equipment such as aircraft, special shelters and communications cabinets. Of general interest will be such items as ladders, chairs, automotive parts, cameras, bakery cabinets, blood shipping containers, hand trucks and others.

Essex Aero, Ltd. of England will show a new all-magnesium automobile body, to be seen for the first time in this country. In addition, actual demonstrations of magnesium manufacturing processes will be shown. Magnesium welding will be demonstrated by the Aluminum Company of America; deep drawing by Brooks & Perkins, Inc.; impact extrusion by Dow Chemical Co.; tube bending by the Magnesium Co. of America; continuous X-ray inspection by Essex Aero, Ltd. of England; high temperature tensile testing by Magnesium Elektron, Ltd., England and H.A.E. electrolytic coating of magnesium by Army Ordnance.

More than 50,000 visitors are expected from military agencies, domestic manufacturing firms and foreign industrial enterprises. The show will be open to the public without charge. A feature of the opening day will be an address by Senator Homer Ferguson.

Included among exhibits will be the Navy Skyrocket plane, an S-55 helicopter, the XP-56 Flying Wing (first all-magnesium airplane), the XC-120 cargo pod developed by Fairchild, a magnesium arctic shelter, a light-weight Signal Corps teletypewriter and a B-47 bomber radar-controlled tail-cone and gun-turret assembly.

* * *

Third Quarter Steel Remains Puzzle

NOBODY in Washington seemed to know what to do about the third quarter steel allotments in early February. Meetings scheduled for later in the month will produce answers, said NPA and industry officials.

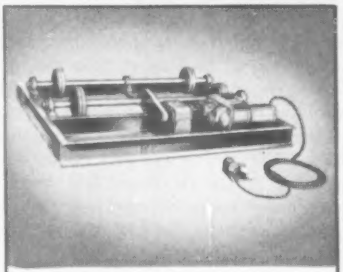
If allotments are going to be "open ended", then users will probably be allowed to draw a percentage of their past requirements. In some instances this could go as high as 115%.

There is a strong likelihood though, that some restrictions may be placed on plate, structurals, stainless and alloys such as those containing tungsten, moly and columbium.

REED ENGINEERING CO.

Modern Metalworking Equipment

- BENDING ROLLS
- TURNING ROLLS
- AUTOMATIC WELDING FIXTURES



REED RD-20R TURNING ROLL

- ★ A top-quality production line turning roll for welding, painting and finishing operations on tanks and other cylindrical shapes up to 1-ton, 6 ft. diameter, 12 ft. long
- ★ Easy-to-adjust reversible variable speed from 10 to 100 IPM
- ★ Motor and "ON-OFF" foot switch included

REED WELDING POSITIONER

- ★ Machined face with cast-in "T" slots
- ★ Machine Tool accuracy
- ★ 10-to-1 speed variation
- ★ Ball bearing work table mounting
- ★ 1000, 2500 lb. models, hand or power tilting
- ★ Rotating ground connection

WE INVITE YOU . . . to write us for specifications, prices, list of REED users near you. No obligation. Just write on your letterhead.

REED ENGINEERING CO.
1007 W. FAIRVIEW, CARTHAGE, MISSOURI

Courtesy General Electric Co.

Job Shop Welds Better With New Meter

A PORTABLE surface resistance indicator has "taken the guesswork out of good spot welding" at the Spotweld Co., Cleveland. The indicator provides a rapid and accurate measurement of the cleanliness of the aluminum to be joined. If the metal surfaces are not as clean as they should be, a high surface resistance between sheets shows up on the meter. The operator knows immediately that to try to spot weld them would likely result in trouble .

In operation, two samples of sheets to be welded are placed between the jaws of a holder linked to the indicator. A pressure simulating pre-welding force is put on the two pieces and the surface resistance shows up on the microhmeter in front of the girl.

Enough samples can be tested in 15 minutes, says the company, to certify sheets for a 12-hour welding run. Spotweld fabricates parts for aircraft engine covers, refrigerators for trucks, aluminum tie rails and parts for vending machines.

* * *

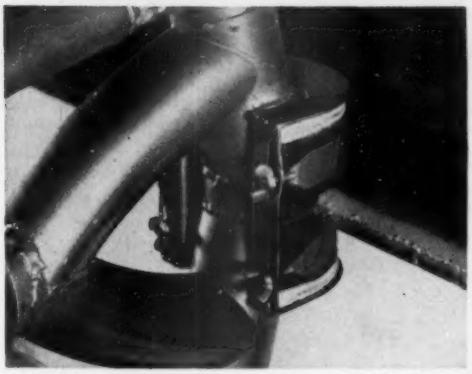
Alloy Rods Carries Theater to California

A SPECIAL movie theater for showing its film on electrode manufacture, "No Finer Electrodes Made . . . Anywhere," will be transported across country to the Western Metal Show by Alloy Rods Co. The 22-minute film will be the feature of the Alloy Rods Booth at the Western Metal Exposition, Pan-Pacific Auditorium, Los Angeles, March 23-27. E. R. Walsh, III, general sales manager of the company, will be in charge of factory and western district sales people handling the exhibit.

* * *

In one year of body building, the Buick-Oldsmobile-Pontiac. Assembly Division of General Motors performs 1,100,000,000 spot welds, 129,250,000 in. of oxyacetylene welding, 37,400,000 in. of inert-gas welding and 10,450,000 in. of arc welding.

PERFECT WELDS
every time
by VACU-BLAST PRECLEANING



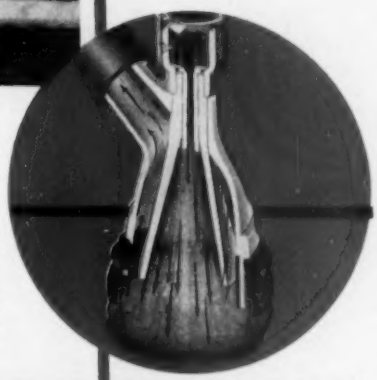
28 GAUGE TO 2 INCH PLATE OR SHAPES

Successful applications include shipbuilding, manufacture of pipe, pressure vessels, drums and pails, and fabrication of steel structures. Either as a portable or fixed unit, Vacu-Blast cleans top, bottom and edge simultaneously to a bright, dustfree finish right ahead of welding. There's no rust or scale to contaminate the weld.

On critical welds that require pressure testing or radiographic inspection, Vacu-Blast precleaning has eliminated over 80% of former rejects. In the welding of pipe, pressure vessels, drums and pails, Vacu-Blast drastically reduces leakage.

PROOF OF A JOB WELL DONE

These radiographs show the difference between welds preceded by Vacu-Blasting and those using less effective cleaning methods.



HOW THE VACU-BLASTER WORKS

In effect it is a miniature blast cabinet enclosed in a brush. Steel grit blast cleans the surface with a thoroughness unequaled by any other method. A vacuum return picks up all abrasive, dust and dirt. None scatters about your plant. All abrasive is reclaimed for reuse time and again.

VACU-BLAST CO. INC.

BOX 885-T, BELMONT, CALIFORNIA

Please send specific detail information applying to the _____ business.

Firm _____

Address _____

Signed _____

Write for free booklet

If you do AC Bronze Welding, Check these Advantages

- No snuff outs
- Easy striking
- Wear resistant
- Corrosion resistant
- Welds dissimilar metals
- High strength
- High ductility
- Can be used with AC or DC

You get them all with AMPCO-TRODE* "AC" Coated Aluminum Bronze Electrodes

THESE Ampco-Trode "AC" advantages mean lower welding costs for you—better, faster jobs—less trouble. Besides the advantages listed you also get a smooth bead that feather-edges perfectly into the base metal — whether it's used on cast iron, malleable iron, bronzes, some nickel alloys, or dissimilar metals.

Moreover, Ampco-Trode "AC" beads are free from porosity and surface pitting. Spatter loss is low, too.

Ampco-Trode "AC" is available in 5 grades having Brinell hardness ranging from 135 to 300, tensiles from 77,000 to 90,000 psi, and yield strengths from 35,000 to 69,000 psi.

For additional information about versatile, money-saving Ampco-Trode "AC" electrodes call your nearby Ampco distributor or write us.

*Reg. U. S. Pat. Off.

AMPCO METAL, INC.
MILWAUKEE 46, WISCONSIN
West Coast Plant: Burbank, California
It's Production-Wise to Ampco-ize!

Burdett Oxygen Founder Honored at Feb. 7 Dinner

WILLIAM H. Loveman, president and founder of Burdett Oxygen Co., Cleveland, was honored by 500 employees at a dinner Feb. 7 at the Beechmont Country Club. The occasion marked the 30th anniversary of the company, founded in 1923 with only five employees.

An all-over-the-world clock and a Sylvia Saul portrait of himself were presented to Mr. Loveman. Now 58, Mr. Loveman has been president and general manager of the company since its founding. Other officers are: E. J. Morse, executive vice-president; Joseph F. Wagner and Norman Carl, vice-presidents; Morris Richman, comptroller and Harold Scherl, head of the export division.

The company's factory at 3300 Lakeside Avenue includes several buildings having more than 100,000 sq ft of space and employs more than 500 people. Most recent expansion of the company was the formation of the Burdett Oxygen Co. of California in Los Angeles for the manufacture and distribution of oxygen, acetylene and welding supplies.

Burdett's carbon dioxide plant was built in 1931. Another acetylene plant was added in 1937. Burdett added a line of welding machines and equipment in 1949 and began the production of safety goggles, helmets, and clothing.

Besides the California plant, there are two at Dayton and Youngstown. Warehouses are in Akron, Cincinnati, Columbus and Mansfield.

* * *

Film Strip Series Helps Arc Welding Instructors

A NEW series of three film strips in full color with a supplementary manual is designed to help teach arc welding. Produced by The Lincoln Electric Co., Cleveland, the series should help welding instruction of high school students, vocational trainees, technical apprentices and farmers.

Titles of the three 50-frame strips are as follows: "Electric Arc Welding and How It Helps Man," "Selecting and Using Arc Welding Equipment Safely" and "Practicing Arc Welding." All fundamentals of joint design, safe practices and practical welding are covered.

The film strips were made by Lincoln in cooperation with the audio-visual division of the Popular Science Publishing Co. Boxed and with supplementary manual, the price is $19.50 for the set.

Build your own business

Flame-Machining Gears, Sprockets

IF YOU do flame cutting and welding, you can build your own manufacturing business quickly, and without great expense, by installing Cogmatic automatic gear and sprocket machine. Cogmatic method makes it possible for you to . . .

- Make gears and sprockets out of high carbon and alloy plate — automatically deep case-hardened for longer wear.
- Sell to ready market, replacing inferior cast-iron sprockets and gears now used on farm, mill and factory, and construction equipment.
- Flame-machine as much tooth metal per hour as is possible with *three* conventional gear cutting machines.
- Automatically cut over 300 different shapes and sizes of teeth . . . 5 to 200 teeth per wheel.
- Flame-cut 3 at a time up to 15" diameter . . . one at a time, up to 108" diameter.
- Offer product engineers and designers the above wide choices where before they were confined to stock sizes, or paid high prices for "specials."
- Furnish industry in your territory 24-hour service on breakdown sprockets or gears.

All information you need to go right into production is available — tables, speed data, practical know-how from our qualified service engineers.

For details, write your address in margin and mail this ad to . . .

C-3

COGMATIC CO.
1330 NORTH FRANKLIN PLACE
MILWAUKEE • WISCONSIN

Western Michigan AWS Plans All-Day Meeting, April 17

A TENTATIVE schedule of events for the all-day meeting of the Western Michigan section of the American Welding Society has been released. Starting at 9 a.m., John Blankenbuehler, AWS district vice-president, will welcome visitors. First speaker of the morning will be Chauncey Hart, Wagner Iron Works, Milwaukee, who will discuss jigs and fixtures for welding. At 10:30 a.m., fundamentals of resistance welding will be reviewed by C. W. Middlestead, C. W. Middlestead Co., Upper Darby, Pa.

Fred L. Plummer, national president of AWS, will be introduced to the Grand Rapids meet following lunch. H. E. Baldwin, R. T. Le Tourneau Inc., Peoria, Ill., will then give a talk on applications of submerged arc welding. Julius Heuschkel, Westinghouse Electric Corp., East Pittsburgh, Pa., will speak at 2:30 p.m. on weld cracking. Last speaker of the day will be T. B. Jefferson, editor of THE WELDING ENGINEER, Chicago. He will discuss arc welding design.

* * *

Flux Effect on Pipe Coatings To Be Discussed by Corrosioneers

FIVE papers ready for presentation during the protective coatings symposium during the National Association of Corrosion Engineers Chicago Conference, March 20 at the Sherman Hotel include one of interest to welding men. It is titled "Weld Seams and Weld Flux Effects on Coating Life" by A. J. Liebman, and will include performance data important to corrosion engineers. Other papers for this symposium include one on coating research in atomic energy applications, exterior coatings for pipes carrying 200 F oil, filiform corrosion, and alloy steel effects on the performance of organic coatings.

* * *

Monel Jackets Protect Offshore Oil Wells

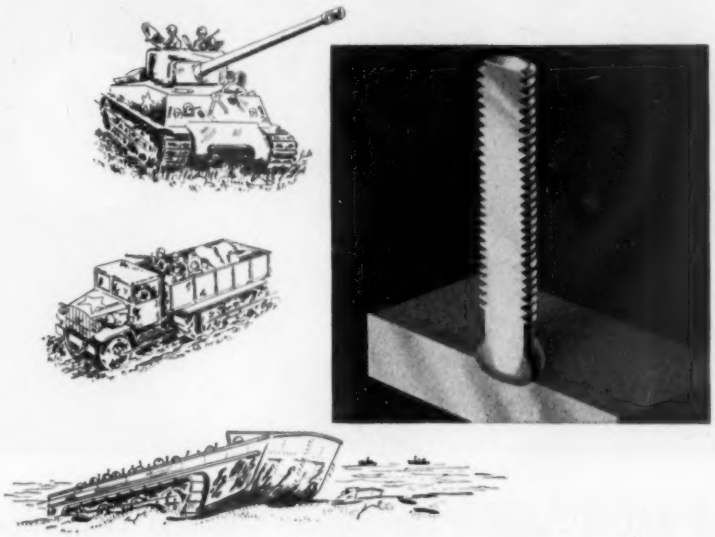
SEA water corrosion has been a problem for some years now for oil companies drilling in offshore waters. The steel pilings that support the drilling platforms have rusted and have sometimes given way.

Recently, long service tests have shown that a Monel sheet wrapped around a steel piling and welded to it will give nearly perfect protection. According to The International Nickel Co. these jackets are only necessary for that section of piling lying between the low water line and the maximum splash line.

improved stud welding
through **K S M** engineering

COST OF ARMORED VEHICLES LOWERED BY

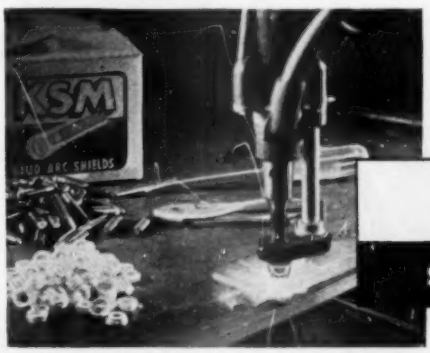
K S M STUD WELDING



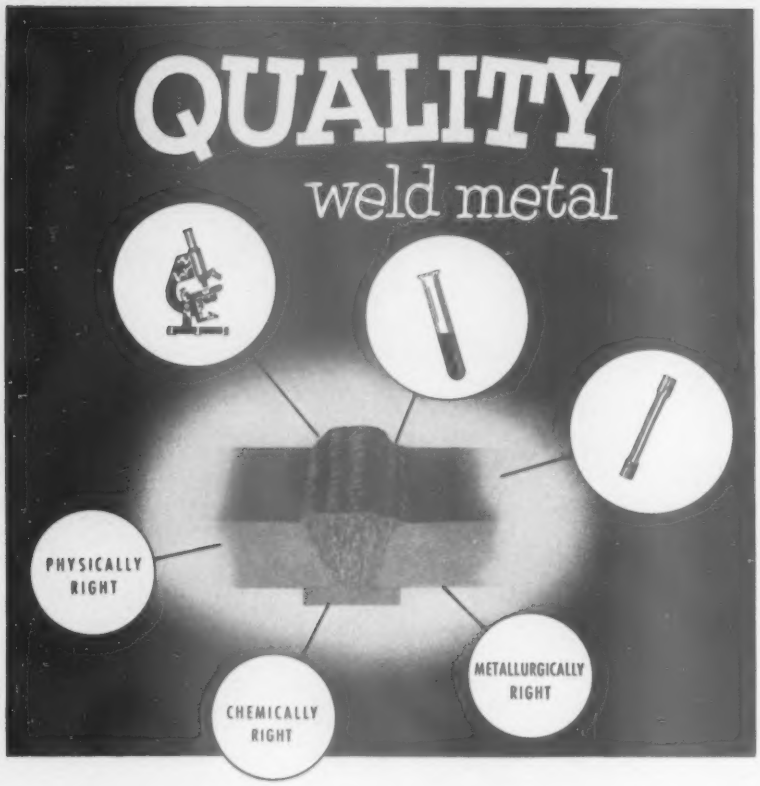
The slow, expensive method of drilling and tapping armor plate for the numerous parts, covers and wireways which must be fastened in armored vehicles has been largely replaced by fast KSM stud welding. Production costs are reduced because KSM stud welding is an inherently faster method. In addition, time consuming rework, frequently required in drilling and tapping due to the characteristic variations in physical properties of armor plate, is eliminated.

The success of stud welding on armor plate is largely due to KSM research. KSM engineers developed a simple method of post-heating to stress relieve the immediate area. This gives base welded material greater strength than that of the fastener.

KSM engineering often reduces fastening costs and improves results. Ask for specific information in terms of your needs. Write KSM Products, Inc., Merchantville 8, New Jersey.



K S M
STUD WELDING



Use ARCOS "Quality Controlled" Stainless Electrodes

The production of top-flight welds largely depends upon the inherent qualities of the weld metal. That's why Arcos Stainless Electrodes must pass so many "quality controls" in manufacture. It's your protection for soundness, specific mechanical or corrosion resistant properties, or microstructures that can stand up to destructive service conditions.

Whatever your welding job, you'll find it pays to put your confidence in Arcos. Backed by long experience with fabricators' welding problems, and research in the behavior of various grades of electrodes in use and weld metal in service—you can trust Arcos Stainless Electrodes to deliver consistently dependable welding results. ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Pa.

WELD WITH ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

Navy Hose Reels Welded From Ampco Sheet and Rod

HOSE reels for refueling the Navy's aircraft and anti-submarine blimps are being weld-fabricated from Ampco 8 sheet and Ampco 15 extruded rod, according to *Ampco Weling News*, published by Ampco Metal Inc., Milwaukee.

Non-sparking quality of the metal was most important in selecting it for this use. During fueling of airships, accomplished while the blimp hovers over the surface craft, there is great chance for metal fittings to strike each other and generate sparks. Not only could this ignite the fuel but also the ship or the blimp.

Aboard aircraft carriers the smaller hose reels are trundled about on the hanger deck or flight deck and are also subject to collision and sparking. While jet fuel is not so inflammable as gasoline, it must be remembered that considerable numbers of the Navy's combat planes are still powered with piston engines and fueling operations remain distinct fire hazards. Other advantages of these alloys include salt water corrosion-resistance, non-magnetic qualities and good weldability.

The largest hose reel holds 400 ft of 2½-in. hose, which is hoisted up to the airship hovering over the refueling craft. Reel is powered by a weather-tight motor together with protected controllers. The entire reel and driving mechanism cover were welded of 1/16 and 1/32-in. Ampco 8 sheet and Ampco extruded rod, with the exception of the actual driving mechanism and controllers. Welding was done by the inert-gas process with 1/8-in. diameter bare filler rods (AWS-ASTM R Cu A1-A2) with a-c and argon gas.

The reel is powered by gearing in which the pinions are Ampcoloy 46-22 and the ring gears are Ampco 18-23 castings. The completely equipped reel, without hose, weighs about 960 lb. The smaller reels for flat-top use hold 100 ft of 2½-in. hose. Constructed similarly to the larger models, they weigh about 225 lb.

* * *

Welded Aluminum Tubing Cuts Exchangers Cost 20%

LOWER cost tubing for aluminum heat exchangers has been developed by Aluminum Company of America. The home office in Pittsburgh disclosed that the new tubes are made by longitudinally butt welding aluminum alloy sheet rather than drawing seamless tubes.

The butt-welding process lowers the cost of manufacture of the finished product 20%.

Smith Welding Equipment Expands Plant

A NEW wing on the present building of Smith Welding Equipment Corp., Minneapolis will add 6,000 sq ft of engineering and test space (see above). Other activities for the new space will include work in quality control and increased tool production.

Smith has set up a "new product" division with trained engineers and designers whose efforts will be directed toward new welding products. In addition, the company is expanding its tool-making department in order to create and build its own special tools, jigs, fixtures. Additional swaging and grinding equipment as well as lathes and special testing instruments are being ordered. Says L. L. McBurney, president, "This expansion is the substance of a firm conviction in the strength and progressive development of the American industrial system."

* * *

Thor Tools Celebrates 60 Years in Business

THE 60th anniversary of Thor portportable power tools will be marked in 1953, announces Independent Pneumatic Tool Co. From a humble beginning in a small Aurora, Ill., machine shop in 1893, the main plant now occupies a block-square factory. Factories in Los Angeles and Newcastle, England, supplement production of the main works.

Pioneers in the power tool field, Thor also dominated the motorcycle manufacturing field in pre-World I days. It also made a brief excursion into the auto industry still earlier when several models of the "Thor VI" were made.

* * *

Steel Mill Difficulties Slow Electrode Production

SUPPLIES of E-6010 electrodes will continue to be short a while longer. This is partly due to the economics and limitations of steel mill practices. In many instances only part of an ingot can be used in order to insure the close .025 phosphor and .08 copper analysis.

Use ARCOS Low Hydrogen Electrodes

As a pioneer in the development of Low Hydrogen Electrodes, Arcos offers you the most complete selection available today. Whether your job involves welding mild steel, high strength-low alloy steels, sulfur-bearing free machining steels, chrome-moly steels, or low nickel alloy steels . . . you can be sure of the results you want.

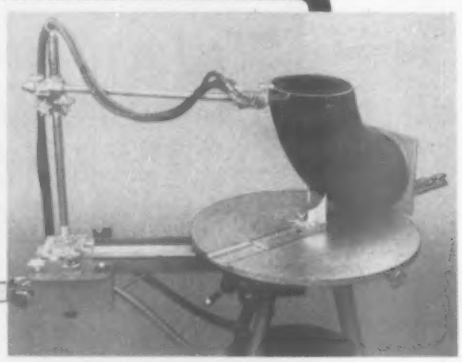
Since 1942 Arcos has been turning out Low Hydrogen Electrodes under Stainless "quality controls". That's your assurance of consistently sound, high-strength welds on every job. It means there's nothing experimental about Arcos Low Hydrogen Electrodes. They've already been "tested and approved" on armor welding as well as commercial applications. ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Pa.

WELD WITH

ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

HERE'S HOW TO
Save
WELDING FITTINGS



VERNON
"Universal" FLAME CUTTER

Use this new precision "Universal" Flame Cutter for re-working, reconditioning and salvaging all types of new and used welding ells, tees, flanges, reducers, etc. Makes extremely clean cuts . . . no cleaning or hand fitting required. Adjustable degree plate permits fitting to be cut at any angle. Has unitized control panel and unitized gas control valve.

Re-cutting a 6" 45° elbow, showing use of the adjustable degree plate.

Write for Bulletin FC-2

WHAT IT DOES

- Shortens ells, tees, flanges, reducers, etc.
- Miters welding neck flanges.
- Re-cuts and bevels used ells, tees, swedges, returns.
- Reconditions welding neck and slip-on flanges.
- Reams extra heavy fittings to standard.
- Cuts small miters . . . 22½° or less.
- Cuts holes in blanks for slip-on reducing flanges.
- Cuts and bevels short pieces of pipe to 36" diameter.
- Makes swedges out of welding caps.
- Cuts miter elbows.

VERNON TOOL CO., LTD.
1093 Meridian Ave. Alhambra, California
P.O. Box 7555 Houston 7, Texas

Vernon PIPE CUTTING PANTOGRAPH
Vernon "Universal" FLAME CUTTER
Brown STEEL VALVES
Vernon-Ormeco TUBE EXPANDING MACHINE

if YOU had to wear them you'd choose
EYEGARDS
The Only Goggles With The 10-Way Ventilation

BEST THING NEXT TO YOUR EYES

● EYEGARDS assure workers the very finest in eye protection and comfort — yet THEY ARE PRICED SURPRISINGLY LOW! Compare these outstanding features! — built-in comfort because the super-light plastic "form-fits" the face — greater protection because of exceptional high impact resistance — extra ventilation through three large vents at side of cup and seven additional vents around the lenses — cool and completely fog free. Get the "inside story" today. Write for free catalog.

● Illustrated is the No. 335 Welder's Cover-spec Goggles. A wide range of other types are available at savings.

AMERICAN INDUSTRIAL SAFETY EQUIPMENT COMPANY
3503 LAKESIDE AVENUE CLEVELAND 14, OHIO
DIVISION OF THE BURDETT OXYGEN COMPANY, Cleveland, Ohio

Eutectic Wines and Dines Sales Representatives

HONORING its salesmen who have been with the company a number of years, Eutectic Welding Alloys Corp., Flushing, N. Y. has been holding a series of testimonial dinners and receptions. Salesmen and their wives were received by Mr. and Mrs. Rene D. Wasserman and Mr. and Mrs. F. F. Roehll. At each meeting, a report on 1952 operations was given as well as new instructions for 1953.

Locations of the dinners included the Statler Hotel in Cleveland, the Pump Room in Chicago, the Deshler-Walleck in Columbus, O., and the St. Regis in New York. A total of about 200 guests were at the dinners.

First of the 1953 sales conferences was held at Atlanta, Ga., the first week in February. The next will be in Los Angeles during the Western Metal Show, March 23-27. Eutectic now has divisional sales offices in Columbus, Birmingham, Chicago and Los Angeles. There is an extension of the Eutectic Welding Institute in Los Angeles to provide welding courses for west coast customers.

* * *

Alloy Rods Appoints Mississippi Supply Co.

NEW authorized distributor in the railway field for Alloy Rods Co., York, Pa., is the Mississippi Supply Co., Chicago. Activities of the new distributor wil be confined to a group of railroads in the Chicago, St. Paul, Minneapolis and St. Louis areas.

Prominently and successfully active in railroad supply business since 1938, the Mississippi Supply Co. will carry the entire electrode line of Alloy Rods. Partners in the firm are Russell E. Long, who resides in Western Springs, Ill. and Richard J. Mulroney, Harvey, Ill. Business address of the company is 80 E. Jackson Blvd.

* * *

New Plant to Make Abrasive Metal Shot

AMERICAN Wheelabrator & Equipment Corp., Mishawauka, Ind., has just completed construction of a new plant specially designed to make "Wheelabrator Steel Shot," a new patented blast cleaning abrasive.

Said to be the largest of its kind in the world, the plant is completely mechanized and is equipped with electric melting furnaces and automatically controlled heat treating equipment. The abrasive is a carbon tool steel that is claimed to reduce consumption and equipment maintenance and increase cleaning efficiency.

Trane Co. Brings Out "Hidden Heat" Baseboard

A NEW hot water baseboard convector for homes and offices was shown by The Trane Co., La Crosse, Wis., at the 11th International Air Conditioning Exposition in Chicago in late January. Said to be comparatively low in cost, the new convector may be installed free standing or may be partially recessed, so that its face is only 1½-in. from the wall. A concave radius curve at the base of the unit makes it easy to clean underneath it.

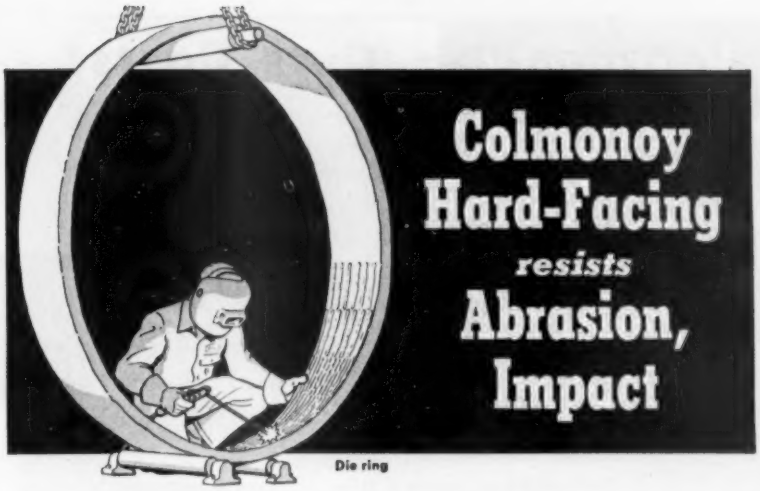
Other new Trane products at the show were a refrigeration machine that is shipped ready for operation and a new type of school room ventilation.

Trane is one of the nation's principal manufacturers of air conditioning, heating, ventilating and heat exchange equipment. During World War II the company began development of brazed aluminum heat exchangers for aircraft. This unusual type of core has rapidly developed important new markets in chemical and petroleum processing, oxygen production and the aircraft, automotive and armament industries. (See THE WELDING ENGINEER, page 33, Nov., 1951).

* * *

Tweco Counter Helper

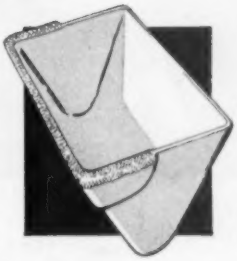
A NEW sales aid for Tweco Products is ready for dealer distribution. It has been produced by the silk screen process in five colors on ¼-in. tempered Masonite. Items on display include the fastest moving holders, connectors and ground clamps. Displays are shipped complete so that no set-up time is required. This type of merchandising aid reflects a growing trend in the welding supply business toward better display and greater expansion of store sales.



Die ring

The examples shown here speak for themselves: Colmonoy meets every hard-facing need with a good alloy and an easy way to apply it.

DIE RING, above, is an excellent example of the use of Colmonoy No. 1 in resisting impact and abrasion. More and more Colmonoy is being used on this and other 'rough' applications, where earth and bulk materials are handled. Colmonoy Special No. 1 is used where abrasion factors outweigh the value of impact resistance. Both alloys are applied easily by electric arc.



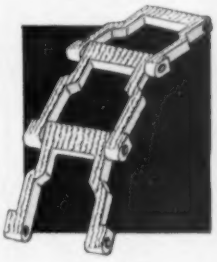
Elevator bucket

ELEVATOR BUCKET LIPS withstand the most extreme wear when hard-faced with Colmonoy Sweat-on Paste. Applied with a spatula, and fused with carbon-arc welding, its hardness of 68-72 Rockwell C gives the utmost in abrasion resistance. Thin sections can be hard-faced with a minimum of distortion by spreading Sweat-on Paste with a brush, and fusing with an oxy-acetylene torch.

Drive sprocket

DRIVE SPROCKETS are best protected with Colmonoy No. 6. Colmonoy No. 6 will give unmatched service on this abrasive application, and it has the unique advantage of being easily formed during its plastic range (1900°—2050° F). After applying Colmonoy No. 6 by oxy-acetylene welding, the deposit is hot formed with a simple die. Excess deposit is wiped off with a cast iron rod. It will outlast hardened steel by four times.

DRAG CHAIN LINKS last longer when hard-faced with the newest iron-base alloy, Wallex. Available in bare and coated rods, Wallex has excellent abrasion resistance, and very good impact, corrosion, and galling resistance.



Drag chain links

The applications mentioned above are but a few of hundreds that have proved the value of Colmonoy alloys in extending equipment service life.

Write for Colmonoy Hard-Facing Manual No. 77. It gives a two-page hard-facing guide and a complete table on the properties of all Colmonoy alloys.

HARD-FACING ALLOYS

19345 JOHN R STREET **WALL COLMONOY** DETROIT 3, MICHIGAN
CORPORATION

BRANCHES: BIRMINGHAM • BUFFALO • CHICAGO • HOUSTON
NEW YORK • LOS ANGELES • PITTSBURGH • MONTREAL

Versatility **Cuts Costs!**

(1) (2)

WELDING—(1) Individual Mixer and Tip Assemblies or (2) Universal Mixer with Swaged Tips. Sizes 00 to 10 (drill sizes 76 to 30).

K-G's AP Welding & Cutting COMBINATION

(1) (2)

HEATING—(1) Acetylene or (2) Propane. 12", 18" or 24". Propane tips interchangeable.

ALL PURPOSE. Takes a wide variety of tips. Excellent for brazing, welding, heating, cutting. Rugged, efficient, dependable.

CUTTING—75° or 90° head. Cutting range: ⅛" to 6".

SEE YOUR K-G DISTRIBUTOR or write for AP CATALOG SHEET

The K-G Equipment Co. (Inc.)
Unit of Air Products, Inc.
Dept. A, P.O. Box 538, Allentown, Pa.

Rebuild WORN TRACTOR PARTS with . . .

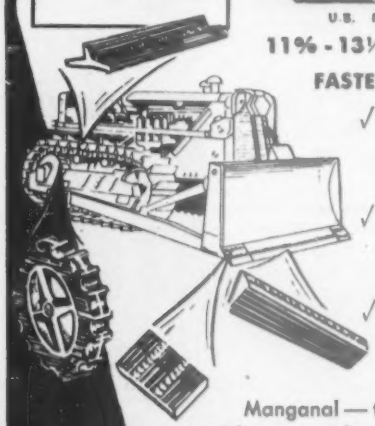
PROVEN BY THOUSANDS TO LAST LONGER

MANGANAL

U.S. Patents 1,876,736—1,947,167—2,021,945

11% - 13½% Manganese-Nickel Steel

FASTER, MORE ECONOMICALLY!



✓ MANGANAL SPECIAL SHAPE APPLICATOR BARS replace worn edges of tractor blade and grousers—cuts down time.

✓ MANGANAL BARE ELECTRODES rebuild drive sprockets, track rollers and idlers — cost less than new parts.

✓ MANGANAL FLAT APPLICATOR BARS rebuild worn corner bits — like new.

Manganal — the toughest metal known not harmed by heat.

Send for catalog and price list

FREE
Literature on the latest methods for speedy and economical repair of worn equipment

NEAREST DISTRIBUTOR UPON REQUEST

STULZ-SICKLES CO.

SOLE PRODUCERS 92 N. J. RAILROAD AVE. NEWARK, N. J.

Government to Standardize On Welding Purchases

PUBLIC Law 436 enacted by Congress has given Defense Department officials the go ahead in setting up standardized purchases of welding and other industrial equipment by the government.

It will be a tremendous program just to standardize the materials. Standardization of welding purchases, however, requires a look at more than just the materials. Right now, work is going on in nomenclature, symbols, definitions of terms, welding techniques and applications. The law gives the power needed to direct and guide the effort of the many departments of the Army, Navy and Air Force. As an example, the Army has seven services, the Navy six Bureaus and the Marine Corps. The Air Force has many commands. A search for a common denominator will be a big job.

The Navy's Bureau of Ships is custodian of many welding specifications. It is understood BuShips will also circulate non-secret specifications to interested parties.

* * *

British Welding School Set for April 27-May 2

THE third summer school of welding organized by the British Welding Research Association will be held at Ashorne Hill, near Leamington Spa, Warwickshire, from April 27 to May 2. This year the general theme will be welding fabrication and production.

Introductory lectures at the school will include critical and comparative studies of welding processes, plant and basic materials. Students will then be given full instruction in welding design followed by lectures on study of works planning and welding costs. The course will also include lectures in the non-destructive testing and inspection of welds. There will be five general groupings of students whose interests lie in aircraft, shipbuilding, structural work, automotive and general engineering.

—*McGraw-Hill World News*

* * *

P. R. Mallory Announces New Distributor for New Jersey

P. R. MALLORY & Co. Inc. has appointed Essex Welding Equipment Co., 17-19 Tichenor Lane, Newark, New Jersey, distributor for Mallory resistance welding products. Essex will maintain a complete stock of electrodes, holders and dies for all resistance welding processes.

Hot-Dip Galvanizing Protects Buried Steel Pipe

GALVANIZED steel having three oz. of zinc per sq ft of exposed surface is highly resistant to corrosion in soils normally corrosive to bare steel. This was shown in a recently completed study by two Bureau of Standards men, Irving A. Denison and Melvin Romanoff, of the Bureau's corrosion laboratory.

For the study, short lengths of both galvanized and uncoated steel pipe, as well as plates of zinc, were buried at 15 test sites for periods up to 13 years. Located in widely separated parts of the country, the test sites covered a wide range of soil properties. After each of five periods of exposure, a set of specimens of each material was removed and returned to the NBS laboratories. When the corrosion products were removed, determinations were made of weight loss, depth of the deepest pits and the percentage of area of the galvanized specimens on which coating remained. Further details of this study are in NBS research paper 2366 costing 10c from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

* * *

25,000 Sq Ft More for American Welding & Mfg.

LATEST addition to plant space at American Welding & Mfg. Co., Warren, O., will be 25,000 sq ft to house new machine tools. Contracts for the new construction have been awarded to the Campbell Construction Co. of Warren. In addition, a contract has been let to double the present production area of the Warren Machine & Die Division of the company. The new space will be used to augment the extensive jet program that American Welding has undertaken for the major aircraft manufacturers.

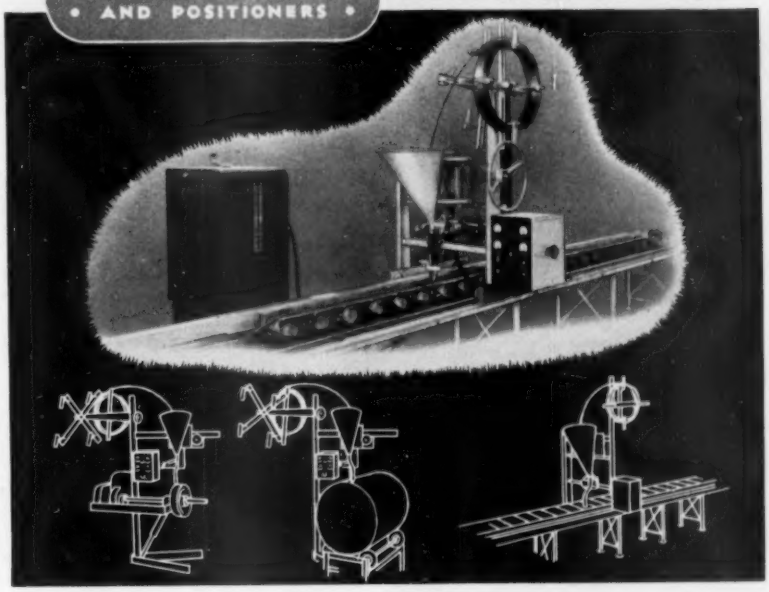
* * *

Maritime Administration Chooses Safety Goggle

THE United States Maritime Administration has standardized on a safety goggle for general use which can also be worn on jobs where a respirator is needed. Respirators fitting over the bridge of the nose do not interfere with these goggles, according to the American Optical Co., manufacturers of the goggles chosen, the "Panoram 600" and 800 goggles. These goggles are adjustable to the contour of the individual's face and protect him from flying particles in a variety of operations.

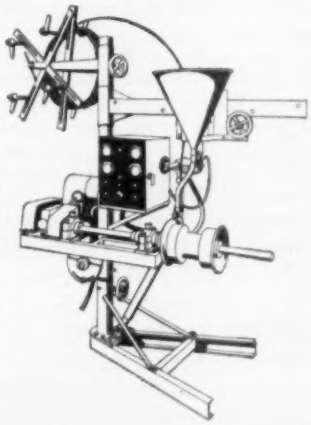
REXARC
AUTOMATIC WELDERS
• AND POSITIONERS •

...for FAST, LOW-COST welding



Here's fast, low-cost welding that is *truly* automatic. Rexarc Welders and Positioners are designed for welding on all types of longitudinal or circular surfaces, such as crawler type tractor rails, scraper blades, structural shapes, fabrications, rollers, sheaves and shafts. All types of positioners for special applications will be engineered upon request.

Outstanding features include: provision for both low and high voltage welding; high frequency starting and stabilization, assuring a steady arc at all times; control over low arc voltage and amperage, which minimizes stress and dilution of parent metal. Welding can be lineal or cross-bead on flat or circular shapes, continuous or in sequence. Removable head is transferrable from one positioner to another.



WELDING ON CIRCULAR SHAPES

Welding on shafts, rollers, sheaves, idlers and similar circular surfaces is simple since rotating spindle is vertically adjustable to accommodate a large range of work sizes. Angular positioning for welding idler and roller flanges, crusher mandrils and similar applications is accomplished by hydraulically controlled elevating device. For welding on long circular work, supporting trunnions equipped with friction bearing rolls are available.

SEE YOUR WELDING SUPPLY DISTRIBUTOR OR WRITE, WIRE OR PHONE

THE SIGHT FEED GENERATOR COMPANY
WEST ALEXANDRIA, OHIO, U.S.A.

A Tip On Acetylene Hard Surfacing

Showing a typical hard surfacing application of Ranite No. 4 on beet harvester part.

Here is a new improved Acetylene hard surfacing rod. Ranite No. 4 is now coated with a thin "Wash Coat" flux. This newly developed metallic flux joins the alloy-core rod, making a tough, hard-wearing overlay (Rockwell Hardness 52-58).

The flux action creates a smooth, clean puddle, easy to apply on thin applications. It deposits an even wearing protective surface for all types of agricultural implements and industrial applications.

This rod gives excellent wearing characteristics up to 800°F. Ranite No. 4 is now available through distributors of the Rankin Manufacturing Company, manufacturers of Ranite welding rods. If you have application for Acetylene hard surfacing, contact your nearest dealer, or write to Rankin Manufacturing Company, 3072 West Pico Blvd., Los Angeles 6, California, for further details.

Three U.S. Companies Help Three Dutch Firms

SOME 100 Diesel-electric locomotives will be built by three Dutch manufacturers with the technical aid of three American companies. Value of the locomotives, to be used on the Netherlands Railways, will be about $15,000,000, according to The Westinghouse Electric International Co.

The three-way agreement will enable the Dutch railroad to obtain units which are American in design, except for such details as couplings and buffers. HEEMAF, of Hengelo, largest Dutch electrical manufacturing concern, which has produced electric traction apparatus under Westinghouse license since 1922, has been awarded a contract for the 80-ton road switching locomotives. Similar information on mechanical components will be provided by the Baldwin-Lima-Hamilton Corp. through HEEMAF to Allan, of Rotterdam, where the engines will also be assembled. National Supply Co., the third American firm participating in the agreement, will provide information on its Diesel engines to Machinefabriek, of Hengelo, where the power plants for the 100 locomotives will be built.

Starting in 1946 with a system that had been virtually destroyed by the war, the Dutch railways under F. Q. Den Hollander as president, have been rebuilt to operate nearly 2,000 miles of track. Some 60% of the line's revenue comes from passenger service and 40% from freight.

* * *

Florida Sands Produce Rutile and Zircon

MINERAL recovery in the Florida beach sands is producing 5% zircon, 5% ilminite and 5% rutile. The residue is also showing a small amount of several elements including garnet and magnesite.

A recent survey made of another beach site in Florida also looks promising. If assays prove accurate it will produce a much larger yield of metal per ton of sand. This deposit also holds ilminite and zircon along with the rutile. Ilminite is one of the basic ores of titanium so many new mining operations are opening up along the Florida coast.

* * *

315,000,000 Lb of Nickel Produced in 1952

TOTAL output of the free world's nickel in 1952 was approximately 315,000,000 pounds. This is an increase of 20,000,000 pounds over 1951 figures.

"Red Head"
WELDING CLAMPS
• Designed for Welding •
No Threads To Damage

1. Case Hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

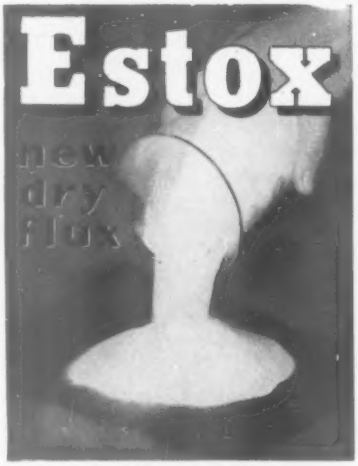
2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1969 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

Estox
new dry flux



FREE FLOWING. Contains new additive that cleans surfaces, insures better joints.

Estox 100—For Cast Iron brazing and welding.

Estox 200—For Brass, Bronze and Silver Brazing. Try it out on your toughest welding job—stainless steel.

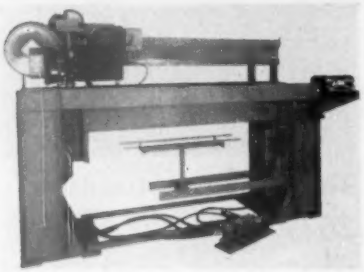
INTRODUCTORY OFFER: Trial Pound $1.50 postpaid.

Two shipping points: New Haven and Detroit

The Standard Supply Company
460WE Grand Ave., New Haven, Connecticut

NEW PRODUCTS

(Continued from page 76)



Stake Welding Machine

265 A NEW Morton Model A stake welding machine incorporates an unusual clamping method. New, flat clamping means eliminate any tendency for the seam to separate under load. This arrangement also offers less interference to inspection by the operator.

The stake, mounted on an air-actuated vertical slide, is supported and aligned at the outer end by a manually-operated shot pin. Inter-locking air valves protect the machine from improper operating sequence. A manually-operated gage bar is built in. High clamping pressure is said to be another Morton feature.

MORTON MFG. CO., Broadway and Hoyt, Muskegon Heights, Mich.

* * *

Tiny Welding Positioner

266 A SMALL electrically-powered welding positioner weighs only 31 lb. but will carry a work load of 300 lb. It comes in bench and pedestal mountings with accessories for inclined and intermittent operation. Turntable diameter is 15½-in. Speeds are variable upward from ¼ rpm. Power source for the "Unique" work positioner is any 110 volt, 60 cycle lighting source.

ALL-STATE WELDING ALLOYS CO., INC., 249 Ferris Ave., White Plaines, N. Y.

"THAT TAYLOR-WINFIELD OUTFIT CAN GIVE US SOME REAL HELP"
"THEIR FIELD MEN WILL SERVICE THE EQUIPMENT"
"THEY WILL ENGINEER THE WELDERS INTO OUR PRODUCTION SET-UP"
"THEIR APPLICATION ENGINEERS WILL SHOW US THE BEST WAY TO RESISTANCE WELD THESE PARTS"
"THEY'VE ALWAYS BEEN KNOWN AS THE QUALITY COMPANY IN RESISTANCE WELDING"

IF YOU HAVE a production **joining** problem, bank on resistance welding and use the facilities of Taylor-Winfield. We have sales and application engineers who spend their time on specific customer projects.

If you will outline your needs, we will give you some practical help. T-W specializes in shirt-sleeve assistance on resistance welding. We design, engineer and build resistance welders into your production line. For prompt attention, address your inquiry to the nearest sales office.

Sales and Service

CHARLOTTE · CHATTANOOGA
CHICAGO · CLEVELAND · DAYTON
DENVER · DETROIT · DALLAS
PHILADELPHIA · PORTLAND, OREGON
SEATTLE · S. PASADENA · ST. LOUIS
WASHINGTON · STAMFORD
DUNDAS, ONTARIO

Resistance Welders Since 1898

TAYLOR-WINFIELD
RESISTANCE WELDERS

THE TAYLOR-WINFIELD CORPORATION • WARREN, OHIO

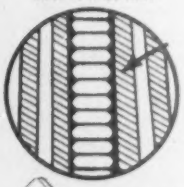
60 more workers

WYPO

Wipes and POlishes
CUTTING and WELDING
TIP CLEANERS

STANDARD SET OF 12
Cleans 27 Drill Sizes.
Nos. 75 to 49 Incl.

JUMBO SET OF 9
Cleans 19 Drill Sizes.
Nos. 48 to 30 Incl.



The exclusive circle design found only in Wypo Cutting and Welding Tip Cleaners provides as many as 60 more cleaning edges per inch of cleaner. Straight sided valleys, another outstanding feature of Wipo Tip Cleaners, insures a thorough cleaning and removal of all waste.

DOUBLE THE LIFE OF YOUR WELDING AND CUTTING TIPS

Fast, easy cleaning without jamming, scratching or enlarging the tip port means added years of service to your welding and cutting tips. Only with Wypo Tip Cleaners do you get thorough cleaning and polishing with one quick and easy motion.

WYPO TIP CLEANERS ARE AVAILABLE AT ALL WELDING SUPPLY JOBBERS

U.S. Patent No. 2,429,581
In Canada 1948

Recommended and sold by the world's largest manufacturers of welding equipment

MAITLEN AND BENSON INC.
1395 Obispo St., Long Beach 4, Calif.

Buy Wypo Tip Cleaners at your welding supply dealers today

FOR ALL PURPOSE WELDING & BRAZING

Send for new 80 page Guide.

SPECIAL ALLOY
GAS and ARC
RODS

PERMALĀTEM
WITH
PERMA-FLUXES

"Surface fusion using new type applications"

PERMALATEM Welding Alloys have won wide acceptance for a variety of purposes. In this handy guide we have attempted to combine in as small a form as possible *for your convenience*, a typical list of applications currently facing the weldor, the welding engineer and top management enabling ALL to select *quickly* the *right* electrode or gas welding rod for a specific job, together with a complete list of our current comprehensive line of welding alloys for torch and electric arc welding.

Reference to this booklet will speedily solve common welding engineering problems for both the engineer and the weldor. Each alloy is described in detail and nothing, therefore, is left to guesswork.

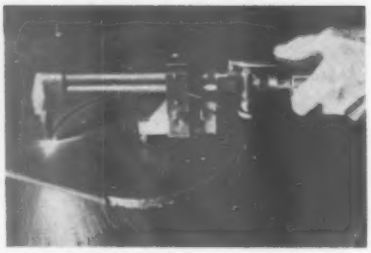
The unvarying high quality and uniform composition of PERMALATEM ALLOYS make them consistently dependable.

This *POCKET SIZE WELDING ENGINEERING GUIDE* will be helpful to you. Write for your copy.

Contact your welding supply distributor for Permalatem Alloys—if he cannot supply you write us directly.

New Pocket Welding Engineering Guide

PERMALĀTEM WELDING ALLOYS, INC.
209 PATTERSON AVENUE
RED BANK NEW JERSEY



Torch Cutting Guides

267 PRECISION guides for flame-cutting straight lines or circles as well as bevels are said to be low in cost and easy to use. Made in styles to fit all makes of torches (from 70 to 90-deg models) the guides are of three principal types, a small circle guide for cutting circles from 1 to 15 in. in diameter (shown above); a large circle guide for 10 to 66 in. diameter and a straight-line guide that can also be arranged for 60 or 45-deg bevel cutting. Guides can be attached to torches in two or three minutes. Built-in positioning fixtures hold the torch tips at correct distances from the metal surface.

NEW ERA ENGINEERING CO., Dept. G-96, 458 West 29th St., Chicago 16.

* * *

Plastic Frame Goggle

268 A NEW plastic frame, spectacle-type safety goggle has been designed to retain the safety lens even when subjected to severe impact. Known as the "Model 707," it is non-sparking and is recommended for the chemical and electrical industries.

Sturdy wire core temples have cable-wound ends that permit easy adjustment for a snug, comfortable fit. Added comfort is found in the large wide flaring nose pads. It comes with flat, 1.25 or 6.00 curve, heat-treated safety lenses.

PENNSYLVANIA OPTICAL CO., 234 S. Eighth St., Reading, Pa.

* * *

NEW PRODUCTS BRIEFS

269 **Edgewound-type** resistors for use in welders, battery chargers, load banks, motor starters, etc., are said to offer high heat dissipation, resistance to oxidation and the ability to withstand shock and vibration without breaking or shorting. Called "Powr-Rib," they are wound with a heavy ribbon of resistance alloy on a ceramic insulator.

OHMITE MFG. CO., 4835 W. Flournoy St., Chicago 44.

About People

A. F. "CHARLEY" DAVIS has been elected president of the board of trustees of the new 200-bed Glenville Hospital in Cleveland. The hospital is noted for its all-welded steel frame and unique square floor plan. Mr. Davis is vice-president and secretary of Lincoln Electric Co. and was chairman of the finance committee that raised $4,000,000 to build the hospital.

* * *

JAMES P. COUGHLIN, manager of field sales for the welding department, Westinghouse Electric Corp., Buffalo, since 1949 has been appointed manager of the arc welding department, according to Tom Turner, vice-president. JAMES O. CLEVENGER, former manager of the welding department, has been promoted to sales manager of the general industrial products division. Mr. Coughlin joined Westinghouse as a student trainee upon graduating from the University of Missouri in 1939. He went to the welding department in Dec., 1939. After three years' Navy service, Mr. Coughlin returned to Westinghouse as manager of welded products in the agency and specialty sales department in East Pittsburgh.

* * *

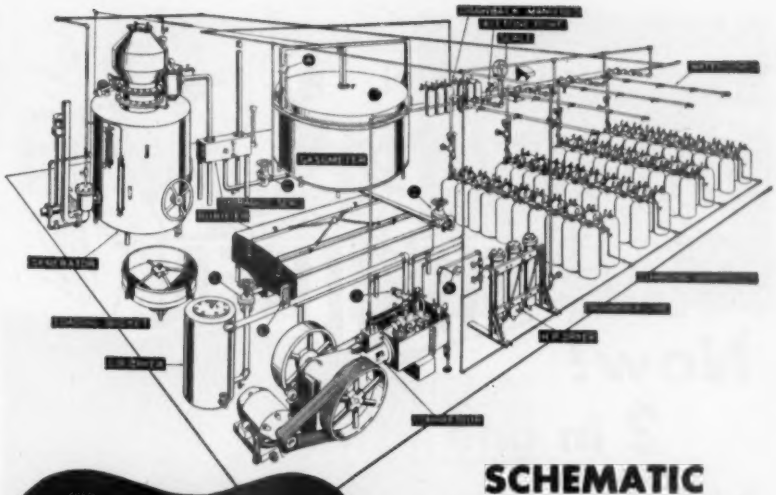
GILFRY WARD has been appointed president and JOSEPH L. MULLIN first vice-president of the American Manganese Steel Division of American Brake Shoe Co. Mr. Ward joined the Amsco division of the company as a trainee in the engineering department upon graduation from Yale in 1928. In 1938 he was made vice-president and in 1948 was placed in charge of sales for the division. Mr. Mullin was formerly vice-president in charge of operations of Amsco.

* * *

L. P. ELLY has been appointed assistant master mechanic, electrical and mechanical maintenance department-blast furnaces, Bethlehem Steel Corp., Bethlehem, Pa. R. A. SEXTON is appointed welding supervisor, service division, to succeed Mr. Elly.

* * *

The following men are newly elected officers of the board of trustees of the National Certified Pipe Welding Bureau: WM. R. STEVENS, Cincinnati, chairman; WRAY M. SCOTT, Omaha, vice-chairman; E. P. EVERHARD, Chicago, treasurer; JAMES C. FITTS, New York, secretary.



A *Low Pressure*
ACETYLENE
PRODUCING
PLANT
that Charges up to
160 CYLINDERS
at ONE TIME

SCHEMATIC PLANT ASSEMBLY

SHOWING LOCATION OF UNITS THAT MAKE UP THE PLANT

This plant layout provides simplest operation at low production costs. Compact design allows operator to watch all operations at all times.

LOW PRESSURE

GENERATOR

This 600-lb. acetylene generator fits into the above plant assembly. It stands out as one of the safest plants manufactured. Automatic controls minimize operating personnel. Rated capacity of the generator and plant assembly is 2700 cu. ft. per hour. The other units are designed for maximum production at minimum costs.

WE INVITE YOUR INQUIRIES

INDEPENDENT ENGINEERING COMPANY, Inc.
Manufacturers of
CONSULTING · RESEARCH · DESIGNING
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN
O'FALLON 5, ILLINOIS

No more "HUNTIN'" with the NEW...

TIP-O-LITER

Now!

2 in one

1. *Thermo Spiral Tip Cleaners*
2. *3 Flint Spark Lighter*

Keeps these essential welding needs right at your finger-tips. Welding quality increases because when cleaners are handy they are used more frequently and clean tips mean better work.

Manufactured by

THERMACOTE CO.

Newark • Chicago • Los Angeles

Buy TIP-O-LITERS today at leading welding jobbers everywhere

R. Balaam

N. Balaam

A new welding supply business featuring route delivery of supplies and consultation on welding problems has been started in Emeryville, Calif., by ROBERT and NORMAN BALAAM. A regularly scheduled motorized delivery service will be maintained throughout principal cities in northern California. Home office of Balaam Brothers will be at 1421 Park Ave., Emeryville. Robert was formerly a partner in the California Welding Supply Co., Stockton and was with Linde Air Products Co. on the West coast for some time. Norman recently resigned from Kaiser Steel Corp. after 11 years in executive posts in Washington, D. C., Oakland and Los Angeles.

* * *

WALTER E. PALMER has been named sales manager of All-State Welding Alloys Co., Inc. He joined All-State in 1951 and has worked in both sales and engineering posts since then. Previous to the last year he was a regional manager. His former employments include eastern manager for Hollup Corp., field sales manager for Alloy Rods Co. and special representative for McKay Co. He is a long time member of the American Welding Society.

* * *

ANTHONY MALADRA has recently been appointed assistant sales manager at KSM Products, Inc., Merchantville, N. J. He was formerly with Shakeproof in the Midwest. Recently KSM opened a new district office in Milwaukee.

* * *

GEORGE S. BOND has been promoted to sales manager of the metals and ceramics division of P. R. Mallory & Co., Inc., Indianapolis. He was previously chief engineer of the metals and ceramics division.

The Champ of Clamps!

THE GRAND QUIKCET DUAL GRIP TYPE "AS"

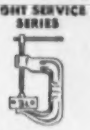
Quick setting double-action clamp grips work more securely. Holds irregular and off-parallel surfaces as well as flat work due to pincer action. Easily tightened in cramped areas.

4 SIZES: 2½" TO 6" OPENING

SPATTER-PROOFED—NACO NO. 6 STEEL (80,000 LBS. TENSILE)

Famous GRAND "C" Clamps

Alloy Steel (Stronger than forged) Spatter-Proofed Screws, Deep Throat—Replaceable Swivels

LIGHT SERVICE SERIES	MEDIUM SERVICE SERIES	HEAVY SERVICE SERIES
		
L SERIES	ASM SERIES	ASH SERIES
8 SIZES 2" TO 12"	7 SIZES 4" TO 18"	8 SIZES ¾" TO 12½"

NCG

STOCKED and DISTRIBUTED BY NATIONAL CYLINDER GAS COMPANY

Offices in Principal Cities

NO INJURIOUS FUMES . . .

"ANTI-BORAX" No. 2 BRAZING FLUX

For Brass, Bronze, Copper, Steel, Malleable Iron, etc. Causes the bronze to penetrate deeper into the joint — making a stronger union than is possible with other fluxes. High efficiency makes it more economical to use. Melting point 300°.

ALSO

1—Cast Iron Welding Flux
3—Brass, Bronze Welding Flux
4—Flux for Bronze Welding Cast Iron
5—Extra Quality Aluminum Flux
7—Steel Flux
8—Aluminum Flux
9—Stainless Steel Flux
11—Tinning Compound
12—Burnt Cast Iron Welding Flux
13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
16—Silver Solder Paste Flux

FOR THE BEST JOB AT LEAST COST

Welders can save more money and get a better job on production work, making special tools, and repair work with the right Anti-Borax product—**order by number.** Send for **free sample** and descriptive circular.

ANTI-BORAX COMPOUND CO., Inc.
FORT WAYNE, INDIANA

Mulroney

Long

RUSSELL E. LONG and RICHARD J. MULRONEY of Mississippi Supply Co., Chicago, will take over Alloy Rods distribution in the railway field for a group of railroads in the Chicago, St. Paul and St. Louis areas. Both Mr. Long and Mr. Mulroney are graduates of the Armour Institute of Technology. For 19 years prior to last October, Mr. Long was with a leading company in the welding field as chief engineer.

* * *

J. W. A. DEBOER has been named western sales representative for Wall Colmonoy (Canada) Ltd. He has been an instructor in welding for the last seven years and is provincial president of the Alberta Association of Certified Welders. He was among the first men in the province to receive a certificate of completion of a study course with the Canadian Welding Bureau and was in charge of the first two welding shows ever held in western Canada.

* * *

A. M. CROSWELL will serve as executive vice-president and WALTER S. RAE, JR., will serve as vice-president and chief engineer for Stracho Engineering Corp., Shreveport, La. Stracho will render such service to the petroleum, power, and chemical fields as welding research, procedure control, inspection, consultation and laboratory testing. For the past two years Mr. Croswell has been welding and project engineer for Gulf Southern Contractors on the 1,200 mile pipe line expansion program of United Gas Pipe Line Co. Mr. Rae, since 1950, has been design engineer for the design development department of the A. O. Smith Corp., Milwaukee. Mr. Croswell was chief spread inspector of construction on the Big Inch pipe line in 1944. Mr. Rae has had extensive experience in design of piping fittings and gas turbine propulsion units.

Salvage Tons of Castings Daily

Fill in Porosity *and* Blow Holes

with DOT-WELDING

Read What Users Say About DOT-WELDING

". . . 8,000 lbs. of castings salvaged per day by Dot-Welding."
Plumbing and Heating Mfr.

"We salvage 75,000 lbs. of grey iron castings from 200 lbs. of welding rod by Dot-Weld Process."
Stove and Castings Mfr.

"We are saving about 75 automobile engine blocks per month as a result of using your equipment."
Engine Rebuilder

". . . 10 to 15 tons of castings reclaimed every 24 hours . . ."
Farm Tractor Company

No foundry or shop can afford to be without Dot-Weld Equipment. This exclusive cold-weld process assures effective, speedy, low-cost repair of defective castings. Also in wide use for press fit work and engine block and head repair—as well as pattern work where metal can be added to worn core boxes.

Low-temperature Dot-Weld deposited metal eliminates possibility of heat distortion and residual stresses. Deposited metal leaves no hard spots on castings. Proved time and money saver. Get the facts today.

Learn about this all-important method for casting salvage. Write for full information on the Dot-Weld Process and equipment today.

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Chicago 24, Illinois

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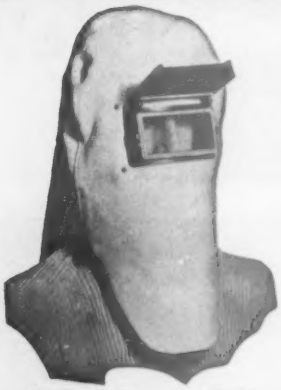
QUALITY
EYE AND FACE
Safeguards



The Welding Helmet for Tight Places

Welders must at times work in boiler flues, narrow passages, or in other places which do not permit wearing the regulation helmet.

This No. 210-S Sellstrom Welding Helmet is purposely designed for use in tight places.

1. The hood is of flexible chrome leather, light-proof and spark-proof.
2. Adjustable standard head gear designed for perfect fit and comfort.
3. Equipped with the new "S" Lift Front plastic plate retainer, with a cover frame of pressed steel for extra protection.
4. The clear protective plate is mounted in an independent stationary frame, behind the filter plate. The protective plate never moves, even if the filter plate is lifted for clear seeing. Thus the eyes are always fully protected.
5. Both sets of plates are held in place by separate tension springs.

This welding hood, combined with the new "Lift Front" plate holder, is ideal for your special welding jobs. Order one or more of these welding hoods for use in "tight" places. If your dealer cannot supply you, write us direct.

sellstrom
MANUFACTURING COMPANY

There's a Sellstrom Safeguard for Every Eye and Face Hazard

626 N. Aberdeen St. Chicago 22, Illinois

HAROLD C. PRICE, president of Harold C. Price Co., pipeline welding contractors, has been admitted to limited partnership in Bache & Co., members of the New York Stock Exchange and other leading stock and commodity exchanges. Mr. Price, who lives in Bartlesville, Okla., is a graduate of Colorado School of Mines. He is a member of the American Welding Society, the American Petroleum Institute, American Gas Association and American Institute of Mining and Metallurgical Engineers.

* * *

A. T. ALLAN has been named manager of brazing product sales for The United Wire & Supply Corp., Providence, R. I. He joined United Wire in 1949. He was educated at Villanova and the Drexel Institute of Technology and has served an apprenticeship in coppersmithing at the New York Shipbuilding Corp.

* * *

C. A. REILLY has been appointed Pittsburgh representative for the Pennsylvania Optical Co., with headquarters at 245 Seaforth Ave. He was formerly with Safety First Supply Co.

* * *

FRANK R. REYNOLDS has been named sales manager of the furnace processing division of Wall Colmonoy Corp., Detroit. He will direct sales activities of the nation's largest jobbing facilities for copper and silver brazing, bright annealing and normalizing. Reynolds was formerly assistant sales manager of Northern Steel Co. and also worked for Detroit Steel Corp.

* * *

WARREN WARE, formerly of the Lincoln Electric Co., Cleveland, is in charge and manager of specialty sales in the welding division of A. O. Smith Corp.

* * *

FRANK V. LOCKEFER is no longer with Mid-States Welder Mfg. Co., Chicago. He has not announced his future plans but can be reached at 4847 Greenleaf St., Skokie, Ill.

MAN! TRY JOHNSON'S NEW BRAZING FLUX... IT REALLY TRAVELS... DOESN'T BURN OUT!

Try JOHNSON'S NEW ALL-PURPOSE BRAZING FLUX on the toughest job in your shop. Find out for yourself that here's a flux that really travels . . . lets you work metal all around . . . thoroughly cleans metal . . . and yet, JUST DOESN'T BURN OUT! For better brazing of steel, cast iron, malleable iron, bronze, copper and copper alloys, use JOHNSON'S NEW ALL-PURPOSE BRAZING FLUX.

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HARGRAVE Tested Tools
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RICHARD L. HOFF has been appointed development metallurgist by Superior Tube Co., Norristown, Pa. Mr. Hoff was formerly in charge of welding research at the Naval Air Experimental Station in Philadelphia. He is a member of the American Welding Society.

* * *

WILLIAM F. TAYLOR has been appointed manager of the structural sections division of The Penn Metal Co., Inc., New York City. He was formerly with Mississippi Valley Structural Steel Co., Chicago, as assistant to the contracting manager.

* * *

DR. J. F. HASEMAN has joined the research and development staff of Foote Mineral Co., Berwyn Pa. As a group leader of the new minerals separation division, he will head up a team consisting of a mineralogist, a chemist and a geologist.

* * *

ARNOLD I. THORSEN has been named assistant director of manufacturing of the Allis-Chalmers Mfg. Co.'s general machinery division.

* * *

Died . . .

GEORGE HINMAN ABEL, 64, president of Eastern Equipment Co., Inc., Willow Grove, Pa., died Nov. 18. He was educated at Johns Hopkins, the University of Munich and at MIT. During World War I he was chief engineer at Thomas Morse Aircraft Co. In 1925 he established himself as an independent welding distributor and opened up the eastern territory for Smith Welding Equipment Corp. He was a pioneer in developing safety goggles from plastic materials, specially designed leather and asbestos clothing for weldors and did much to improve cover lenses for welding goggles and lenses.

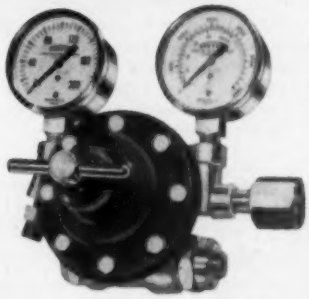
* * *

GERALD ELDRIDGE STEDMAN, 56, frequent contributor to THE WELDING ENGINEER, and publisher of *Private Executive Report*, died Jan. 21 at Milwaukee, after a six months illness. He was widely known in the advertising and business writing fields. He was formerly vice-president of Grinnell and C. C. Winningham Agencies, Detroit, during the 20's, and was vice-president of Cramer-Krasselt Co., Milwaukee, from 1929 to 1939. During World War II he expanded his writing activities, becoming the most widely traveled industrial writer in the country. He is survived by his widow, Margaret A. Stedman, whose photos often accompanied her husband's feature articles in this magazine.

Here's Why Experienced Welders *prefer* SMITH BALL BEARING REGULATORS

FOR WELDING AND CUTTING:

1. **Smith Regulators give accurate, dependable, trouble-free control of gas pressure.**
2. **Simplified design with no complicated mechanism . . . no delicate short-lived parts.**
3. **All parts easily accessible for quick cleaning, adjustment or repair.**
4. **Low cost maintenance and long years of service.**

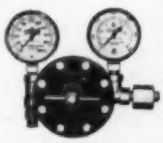


A favorite for over 25 years

Single Stage or Two Stage . . . . SMITH REGULATORS are DEPENDABLE and require less maintenance.

This is precision equipment, based upon years of practical experience in the business and built to give years of service. Best proof of consistent satisfaction is the wide-spread popularity of Smith Regulators from coast to coast. This acceptance has been *earned*—on the job. One thing welders like is the ease of making repairs when necessary. It takes only 10 minutes to change a seat, 15 minutes for a new nozzle and 20 minutes for a diaphragm. No special tools necessary. No long delays. Smith Regulators keep production rolling.

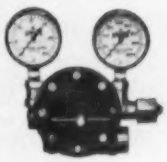
A TYPE FOR EVERY NEED



Type BB Single Stage

Smith's Type BB Single Stage Regulators (Oxygen and Acetylene) provide an even delivery of gas for general welding and cutting. They are the old standby of the Welding Trade for 25 years.

Smith's Type BB-2 Two Stage Regulators soften the drop from high cylinder pressures to operating pressure without fluctuation for all types of welding and cutting as well as hard facing and alloy welding. Keeps torch flame at same adjustment without variation until torch is shut off. Smith also makes Line Regulators, Hydrogen Regulators, Air Regulators and other special purpose regulators. Write us for further information.



Type BB-2 Two Stage

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IF your brazed joints have low strength, or leak . . .

IF you get joint voids, inclusions, and generally poor brazing results

DON'T blame the brazing alloy, the operator, or the brazing process until you have checked the capacity of the flux you are using . . . for more brazing failures are caused by the use of an unsuitable flux than by brazing alloy variables.

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This new free 12 page illustrated bulletin RESEARCH STUDIES OF BRAZING FLUXES will give you a better understanding of flux functions and flux efficiencies and will mean better brazing at lower costs. Ask for Bulletin F-37.

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Minneapolis Akron Hartford, Conn.

30 YEARS AGO

(Taken from THE WELDING ENGINEER *of* March, 1923)

REPAIR on the right-of-way is the story of a Westinghouse ad on arc welders this month. A broken frame on a steam locomotive stopped it on the main line and threatened to cause a headache for the railroad, the passengers and the freight customers. A Westinghouse salesman came along, arranged to bring out an arc welder from a nearby town and repaired the break in a matter of several hours. The same tractor that pulled the welder to the stalled locomotive was used to operate the welder.

—30 YEARS AGO—

ARC welding a break in a 36-in. pipe while it was under 90-lb pressure was the feat recently performed by John Foulks, chief engineer of the water bureau at Newark, N. J. The hole was first stopped with a pine plug cut off flush with the surface of the pipe. This was covered with a metal cap, held in place by tacking it to the sides. More weld metal was then deposited over this cap and around the edges to make a permanent bond.

—30 YEARS AGO—

BARBECUED steer, 700 lb of it, was the drawing card for a recent welding show at Tulsa Oxy-Hydro Co., Tulsa, Okla. More than 300 weldors, purchasing agents and customers showed up to hear the welding talks and see welding and cutting demonstrations. One of the demonstrating technicians was I. F. Fausek of Modern Engineering Co., St. Louis.

—30 YEARS AGO—

A COMPLETE line of oxyacetylene welding and cutting torches and other equipment has been announced by the Burdett Mfg. Co., Chicago.

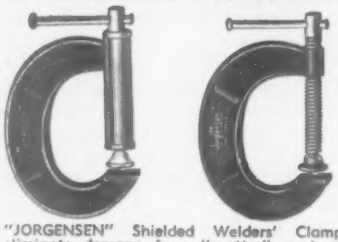
—30 YEARS AGO—

A COMPLETE questionnaire for examination of welding operators has been prepared by the Chicago section of the American Welding Society. More than 150 pertinent questions, divided in arc and gas categories, are included. People making up the report include O. L. Howland, H. Ullmer, F. J. Maeurer, R. G. Mason, E. S. Hurd and C. F. Ebright.

—30 YEARS AGO—

VERSATILITY is required of the weldors at Pioneer Iron Works, Sioux City, Ia., says a northern Iowa correspondent. Repairs range from darning needle size up to tractor engine boilers.

"Jorgensen" and "Pony" CLAMPS for WELDERS:



"JORGENSEN" Shielded Welders' Clamps eliminate damage from "spatter", and are low-priced. "Regular" "C" clamps are available too, if preferred.

"PONY" Clamp Fixtures make ideal bar clamps on any length of black pipe. Fast operating—sure holding—and most economical.

"JORGENSEN" Steel Bar Clamps are designed for the severe requirements of welding service; exclusive "multiple disc clutch" makes for instant adjustment—economy. The trade-mark "JORGENSEN" or "PONY" on your clamps is assurance of utmost satisfaction in service—specify and insist upon them from your supplier. FREE CATALOG ON REQUEST.

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"The Clamp Folks"
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Ask for ALLOY SPECIALTIES CO. NO. 1270 AND NO. 1300 BRAZING RODS

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Ask your local distributor for further information or write for free literature.

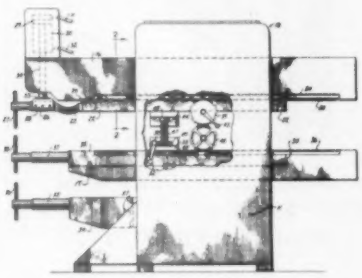
SOME DISTRIBUTOR TERRITORIES STILL OPEN

ALLOY SPECIALTIES COMPANY
SWISSVALE, PA.

From the Patent Office

Versatile Spot Welder

2,623,972. BERNARD GROSS, San Diego, Calif. Assigned to Rohr Aircraft Corp., Chula Vista, Calif. Filed Oct. 6, 1951. Granted Dec. 30, 1952.



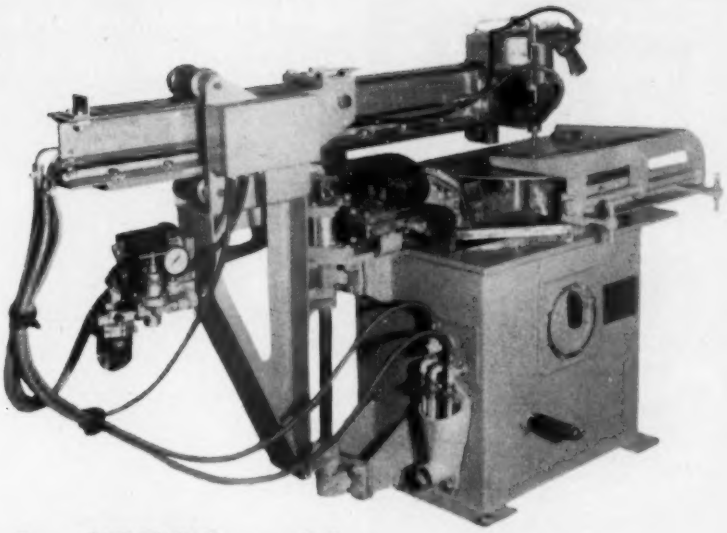
A newly patented spot welder features specially-adjustable electrode holders that can be moved closer together or closer to the frame. They are operated by a manual control that operates gearing attached to the holders. In one position of the control, both electrode holders move simultaneously toward or away from the frame. In the second position, one of the holders moves toward the other.

* * *

Pipe Flash Welder

2,623,973. SVEN MALKE, Milwaukee. Assigned to A. O. Smith Corp., Milwaukee. Filed Jan. 18, 1951. Granted Dec. 30, 1952.

This patent covers a machine for flash welding the opposed longitudinal edges of a tubular blank. It includes a frame and a pair of rockers carried by the frame and arranged opposite each other for inward operation upon the blank. A first pair of dies is secured to the rockers and shaped to engage the blank next to the longitudinal edges. A second pair of dies is movably mounted on the rockers for engagement with the back of the blank. Means carried by the rockers move the second pair of dies to clamp the blank against the first pair of dies. Means supply welding current to the full length of the blank edges. Other means actuate the rockers and thus the dies to move the edges together and apart and effect flash welding of them.



the $7500 welder that saved $25,000 the first year

A machine that increased production enough to effect savings that were double or triple the machine cost during the first year is news to many fabricators not familiar with the versatility of the modern resistance welder. With one man this machine will take the place of four conventional guns and two rocker arm welders requiring a total of six operators. It also eliminates the loss of production due to the unnecessary shifting of the work pieces between operations.

Here is factual proof that special equipment effecting cost saving need not be expensive.

Recent Federal designed and built machines have combined assembly with welding, forming with welding and high speed multiple-shop welding of complete assemblies.

This is part of the reason why—from the start—Federal has always been First In Resistance Welding.

This inner bulkhead assembly for an automatic dryer requires about 50 spot welds. Federal designed a new type expansion gun welder (above) where the gun is supported on the end of a horizontal beam mounted on rollers—moves in all directions—automatically welds as operator squeezes pistol trigger. Manufacturer figures this has saved $25,000 over old method during first year.

Federal WELDERS ®

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THE FEDERAL MACHINE & WELDER COMPANY
WARREN, OHIO

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It makes sense to make your A-S Distributor and All-State your one proven source for all alloys and fluxes needed for welding, brazing, soldering, tinning and cutting.

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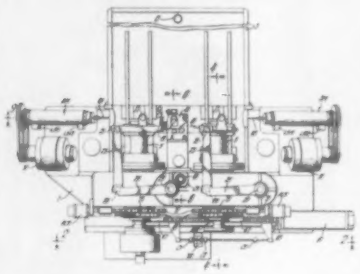
WELDING ALLOYS CO., INC.
White Plains, N. Y.

Automatic Indexing Drill Press and Flame Cutting Machine

2,619,707. Leo L. Young, Albert C. Drechsler and Bronislaw T. Brzozowski, Cleveland. Assigned to General Motors Corp., Detroit. Filed Jan. 27, 1950. Granted Dec. 2, 1952.



This patent refers to a flame-cutting machine which is a combination of a machine frame with a work-supporting mechanism rotatable within it. An indexing mechanism on the frame is operably connected to the work supporting mechanism. A template on the frame has an opening on it. A cutting torch attached to a template tracing mechanism is supported on the frame for movement in a plane next to the supporting mechanism. The tracer mechanism has a rotatable tracer roller retained in driving engagement with the wall of the template opening for moving the torch. A drilling mechanism is attached to the frame in spaced relation to the cutting torch and a template ramp is movable into the template opening. The latter is engageable by the tracer roller for positioning the cutting torch in alignment with holes drilled by the workpiece mechanism upon operation of the indexing mechanism to start the cutting operation by the torch.

* * *

Method of Welding Molybdenum

2,623,975. Ward W. Watrous, Jr., Chatham, N. J. Assigned to Chatham Electronics Corp., Newark, N. J. Filed Nov. 8, 1951. Granted Dec. 30, 1952.

This patent covers a method of welding two pieces of molybdenum and comprises the following steps. First, depositing a layer of flux material on the surfaces to be joined. The flux comprises a mixture of equal parts of powdered molybdenum and powdered nickel, a binder material and a solvent for the binder. Next, the pieces are heated in a furnace to a temperature between 1742 and 2,102 F for at least 10 minutes. The pieces are then spot welded together in a spot welding machine.

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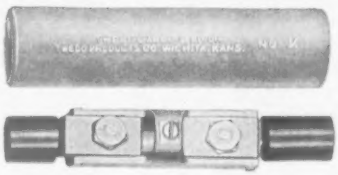

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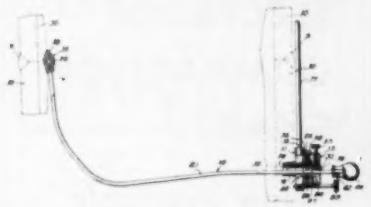
WICHITA, KANSAS

Radiographic Inspection Device

2,622,209. JULIUS A. HJULIAN, Palos Heights, and IRVING H. CARLSON, Chicago. Assigned to Crane Co., Chicago. Filed April 26, 1950. Granted Dec. 16, 1952.

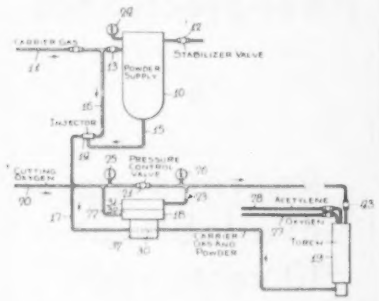


This patent covers a holder device for radiographic inspection of normally enclosed objects such as pipe or the like, the combination comprising a hollow member to be inspected having a survey aperture. The base member has a threaded shank and opening through it. The base member is mounted in a wall of the pipe to be inspected. A predeterminately formed rod is adjustably mounted in the opening in the base member, and extends into the hollow pipe. Means are provided on the rod end for carrying a radioactive substance or the like.

* * *

Flux Powder Control in Flame-Cutting

2,622,548. ALFRED F. CHOUINARD and JOHN F. DOVE, Chicago. Assigned to National Cylinder Gas Co. Filed Dec. 9, 1947. Granted Dec. 23, 1952.



This patent refers to a conduit system for delivering flux forming powder and a carrier gas to a flame-cutting torch. It includes a collapsible section and means for controlling the flow of powder and carrier gas through it. The means includes a member acting on the section and a spring acting on the member to operate the latter and close the section. A diaphragm acts on the member in opposition to the spring. There are means for applying to one surface of the diaphragm oxygen under the pressure delivered to the torch for cutting.

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes at the source with local exhaust hoods has proven most practical in operation. It is particularly helpful in winter months when doors and windows are closed. Write for Bulletin 37-D describing all types of Ruemelin Fume Collectors.

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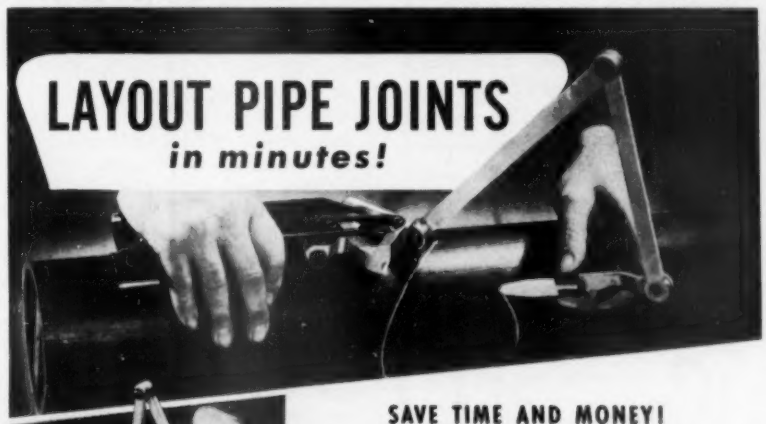

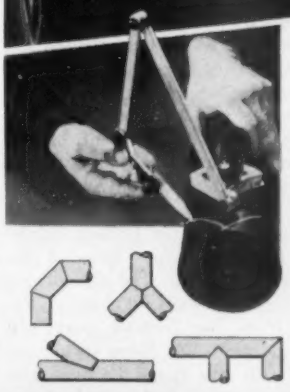

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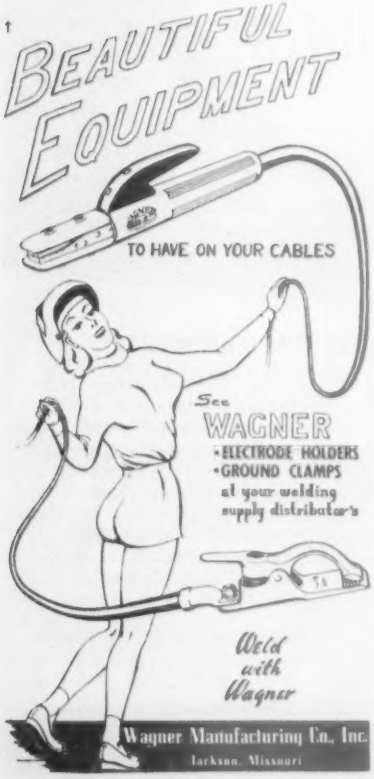
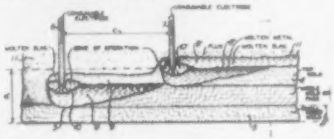
744 Broad St. **Newark 2, N. J.**



Submerged-Arc Welding Method

2,620,423. MAX KOMERS, Muelheim-on-the-Ruhr, and HERMANN POTZL, Munich, Germany. Filed March 30, 1950. Granted Dec. 2, 1952.

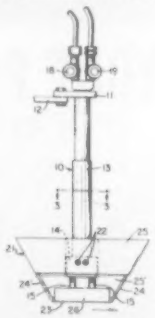


This patent covers a method of submerged arc welding steel sections of considerable area. Welding is accomplished by at least two spaced-apart electrodes moving at different speeds. Fused electrode metal is deposited from the leading electrode and a major part of it allowed to solidify. Fused metal from the following electrode is then deposited on the partly solidified metal by melting the following electrode in the liquid slag, and, if any, the liquid residual melt of the first electrode. The spacing between the electrodes is correlated so that the previously deposited layer of welded metal remains substantially solidified.

* * *

Air-Cooled Heating Torch

2,618,321. GEORGE R. SPIES, JR., Berkley Heights, N. J. Assigned to Air Reduction Co., Inc. Filed Oct. 15, 1948. Granted Nov. 18, 1952.



A newly patented gas heating torch comprises a head with a number of tips fastened to it and projecting downward from the head. The head has passages for conducting heating gases to the tips. A heat-dissipating shield is secured to the head, having a bottom portion provided with tip-receiving openings into which the ends of the torch tips project. The torch tips project no farther downwardly than the lower face of the bottom of the shield. The shield also has a pair of walls extending upwardly from the bottom part and straddling the head. Heat insulating material fills the space between the end of each tip and the wall of the tip-receiving opening into which it projects. Heat dissipating fins project from the walls.

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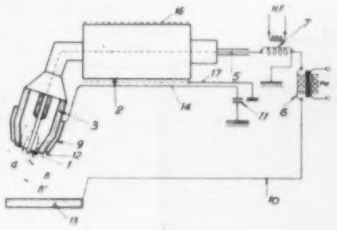
Arc Welding Apparatus

2,620,422. CHARLES VOLFF, Montreal, Quebec. Assigned to L'Air Liquide, Societe Anonyme pour L'Etude et l'Exploitation des Procedes Georges Claude, Paris, France. Filed Aug. 3, 1951. (In France, Aug. 31, 1950.) Granted Dec. 2, 1952.



A newly patented arc welding apparatus has an electrode connected to a welding current source the other pole of which is connected to the workpiece. The electrode is surrounded by an insulating piece. An electrically conducting ring surrounds the exterior of the insulating piece. The electrode and the workpiece have direct connections to the respective poles of a h-f generator producing continuous waves. An indirect connection is made only between the ring and the pole of the h-f generator which is connected to the workpiece. The indirect connection includes a capacitor having a high reactance to the welding current. The distance between the electrode and the ring in respect to the h-f potential is sufficiently high to produce a luminous discharge around the electrode. The ring is placed on the front part of the insulating piece whereby it is adapted to produce the said luminous discharge around the front part of the electrode.

* * *

Silver-Indium Soldering

2,623,273. WILLIAM S. MURRAY, Utica, and MARIA T. LUDWICK, New York City. Assigned to The Indium Corporation of America. Filed May 5, 1945. Granted Dec. 30, 1952.

This patent refers to an article having a soldered joint in which adjoining surfaces of base metal are bonded together solely by a single solder alloy consisting of 3% silver, 1 to 5% indium and the balance lead.

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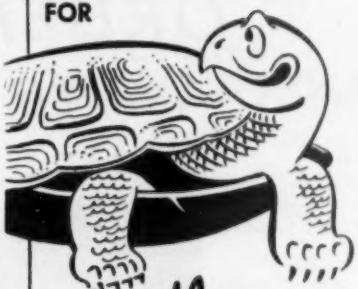

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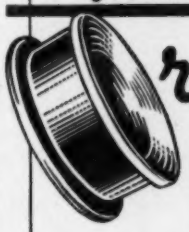

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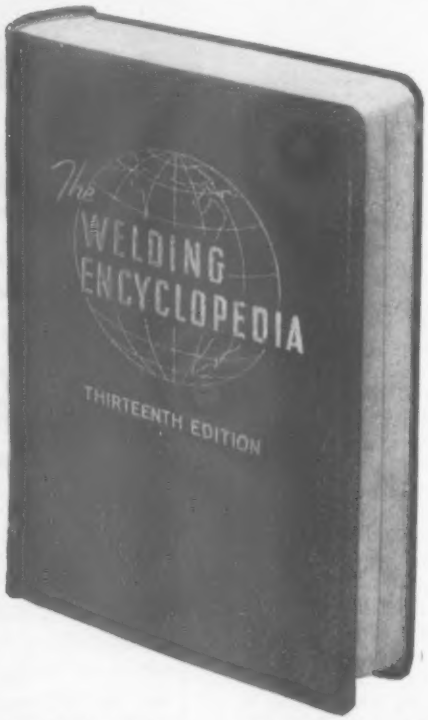

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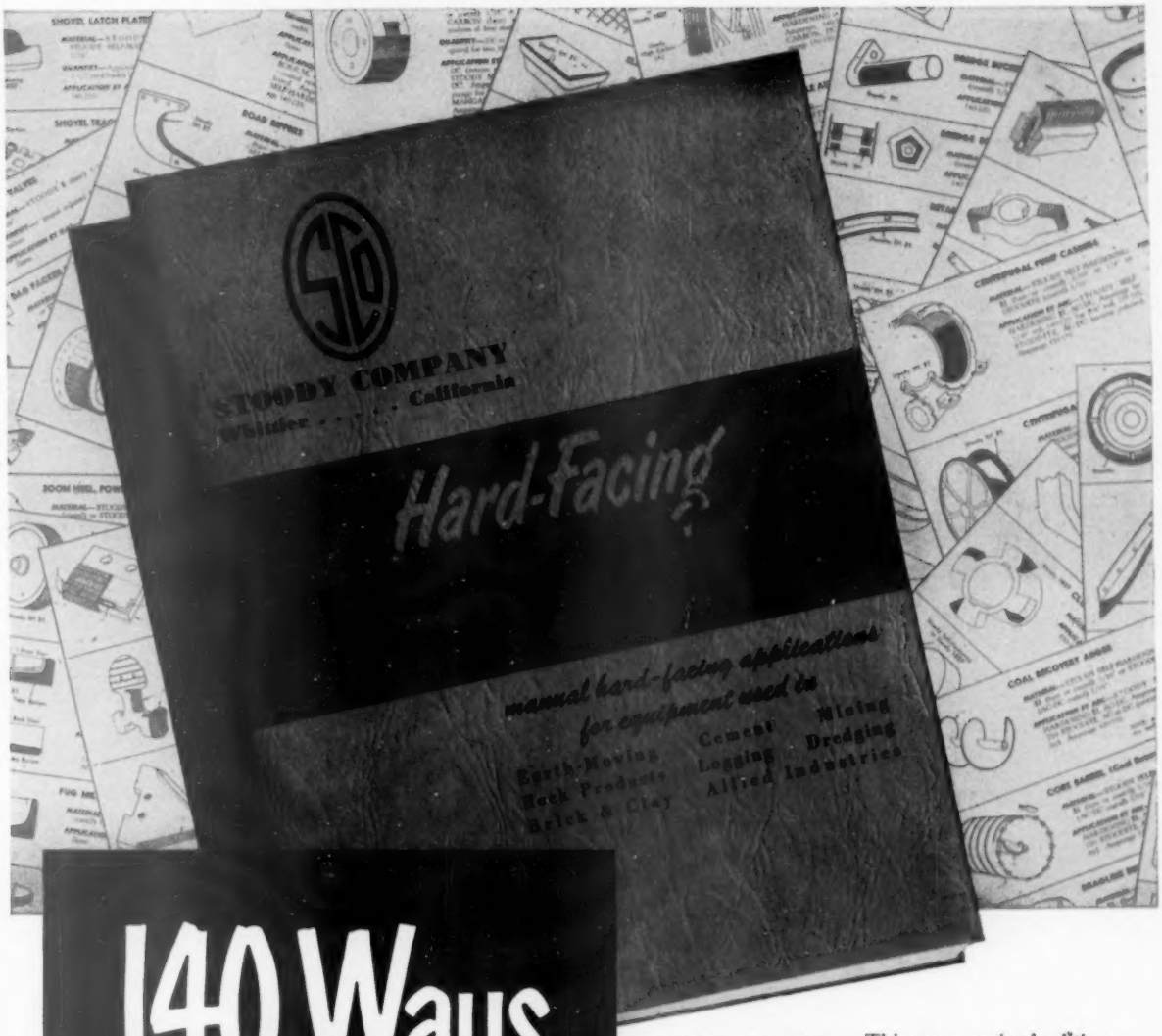

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